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CRDEC-TR-86041

ENGINEERING DEVELOPMENT OF THE SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENT: TRAINING M256 (TRAINS)

by Lionel Katzoff
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DETECTION DIRECTORATE

June 1986

U.S. ARMY
ARMAMENT
MUNITIONS
CHEMICAL COMMAND

Aberdeen Proving Ground, Maryland 21010-5423

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A Simulator, Detector Tickets, Chemical Agent; Training, M256 (TRAINS) device entered engineering development on an accelerated basis. There was no advanced development phase. The TRAINS was accepted into the Army inventory as a stock-funded item with a follow-on evaluation before full production.

The TRAINS was developed as a training device for the M256 Chemical Agent Detector Kit. "Pre-engineered" color changes were incorporated into the M256 samplers to produce the color required to simulate a positive test without the use of external simulants or agents. For example, pH indicators were used as positive tests for blister agents, and the removal of cholinesterase from the nerve agent test spot for positive nerve agent tests. A variety of unexpected problems were overcome during this development program. The most important

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18. SUBJECT TERMS (Continued)

Detector kit
pH indicator
Simulate

19. ABSTRACT (Continued)

of these involved environmental considerations. The original simulation of the blood agent test incorporated potassium cyanide in the M256 glass ampules. By this means, the reactions required for the AC test were closely duplicated. However, late in the development cycle, the EPA changed regulations regarding the disposal of materials containing cyanide. Even though the amount of cyanide was well below toxic amounts, hazardous waste disposal methods more stringent than for normal waste were now required for this device. This was not acceptable to the Training and Doctrine Command. A solution was found by simply substituting the same pH indicators used in the test simulation for blister agents for the test simulation for original blood agents.

PREFACE

The work described in this report was authorized under Task 1N464-725D020, Chemical Detection & Warning System. Work was started in March 1981 and completed in September 1983. The experimental data are included in Notebooks 10,085, CSL 81-0033 and 0047. Test items were fabricated under Contract DAAK11-81-C-0071 with the Chemical Compounding Corporation.

The use of trade names or manufacturers' names in this report does not constitute endorsement of any commercial products. This report may not be cited for purposes of advertisement.

Acknowledgments

The authors wish to acknowledge the important contribution of the following Configuration Control Board members that made the successful completion of the development program and acceptance of the device possible: Anthony Subrizi, William Fields, and Corrado Depinto, Research, Development and Engineering Support Directorate; Richard Vigus and Peter Annunziato, Producibility Engineering Division, Detection Directorate; Richard Pyatt, William Shulman, and Janice Paige, Environmental Technology Directorate; Joel Lloyd and David Labar, Programs and Resource Management Directorate; R. Merkey, Human Engineering Laboratory; Joseph Novad and J. Wassum, Maintenance Directorate; Joseph Trost, James Delp, and C. Chan, Product Assurance Directorate; and Marianne Gunn, Procurement Directorate.

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CONTENTS

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ENGINEERING DEVELOPMENT OF THE SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENT: TRAINING, M256 (TRAINS)

1. INTRODUCTION

The Army is required to train both individuals and units to survive under conditions of chemical warfare. As part of this training, soldiers must learn and become skilled in the operation of detection and warning equipment for chemical agents.

This is a report of the development of a "pre-engineered" training device for the M256 Chemical Agent Detector Kit. Currently, the M72A2 Simulant Chemical Agent Identification and Training Set (SCAITS) is used to simulate the action of agents on the M256 Kit, but it is only usable in classroom situations. A training device that can be used in field exercises and the Army Training and Evaluation Program (ARTEPS) is required. The Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) was developed to meet the requirement.

2. BACKGROUND

2.1 Administrative.

The exploratory development (XD) program for a training device to be used for the M256 Chemical Agent Detector Kit was started in October 1978. The XD program was an attempt to find a color-forming chemical reaction sensitive to butanethiol that would be sufficiently stable for use in the field and viable after long-term storage. Various reagents reported in the chemical literature were tested but were either not sufficiently stable or of the desired color. Because such a reaction could not be found easily and the desired Initial Operational Capability (IOC) date (FY83) could not be met, a pre-engineered device was considered. A pre-engineered device is one that gives the desired responses when activated but does not require external simulant to do so. This concept was accepted, and an accelerated program was initiated. The advanced development (AD) phase was omitted and engineering development (ED) started in 2d Qtr FY81. The project was considered a priority 3 in the Statement of Work for the Training Device RDTE Program Requirement (January 1978). An approved Training Device Letter Requirement (TDLR) dated November 1980 (Appendix A) was received that stated that, as an interim solution, the pre-engineered device was acceptable to meet the desired IOC in 1983. The Baseline Cost Estimate (BCE) shows a planned initial procurement goal of $3.58M (FY82 dollars) for 552,350 samplers.

At a Special In-Process Review (IPR) held 25 August 1981, the following positions were established:

"• The pre-engineered device (TRAINS I) is acceptable as a training device for the M256 Chemial Agent Detector Kit.

• The Basis of Issue (BOI) in the current TDLR requires revalidation by TRADOC.

• The current TDLR will be used to support continuation of the 6.4 efforts on the pre-engineered device."

Initially, a combined DT Operational Test (OT)/II was to be performed by Chemical Systems Laboratory (CSL)* under the direction of the Test and Evaluation Command (TECOM). TECOM was to provide a test director and the Training and Doctrine Command (TRADOC) a deputy. Subsequent to this understanding with the US Army Chemical School and agreed to at the Special IPR, TRADOC disallowed a combined DT II/OT II. The project engineer was notified of this change about 23 December 1981. The DT II, however, was completed by the Development Support Division,** CSL, and witnessed by TECOM's representative from Dugway Proving Ground (DPG). The testing was completed satisfactorily, and a test report (Appendix B) from Development Support Division, CSL, was sent for review and used in the preparation of a final test report to be used by TECOM in their independent evaluation report (IER). The IER was completed in July 1982 by the Evaluation Division, TECOM (Appendix C). The TRAINS was considered ready for acceptance into the Army Inventory as a stock-funded item. A separate OT II was performed 2-6 August 1982 by the US Army Armor and Engineer Board at Ft Knox, KY. The delay in performing the OT II occurred because of the time required by the US Army Chemical School to obtain an approved independent evaluation plan (IEP). The OT II was performed in August 1982 and the IER completed in October 1982.

Both the BOI and the characteristics section of the TDLR were revised to meet the requirements of a TDLR. The BOI was revised downward from over 2,000,000 training devices to 848,400, and the characteristics section was revised to delete those characteristics that address a simulant detector.

Both a Physical and Functional Configuration Audit were performed for the TRAINS.

A Development Validation (DEVA) IPR was held by correspondence in September 1983. The following positions were established:

"• Accept the Simulator, Detector Tickets, Chemical Agent, Training, M256 (TRAINS) into the Army Inventory as a stock-funded item with all chemicals removed that cause a hazardous waste disposal problem and with color dyes included that do not cause a false negative response.

• An expanded first article test and a follow-on evaluation (FOE) will be conducted by the US Army Chemical School to confirm that changes have not degraded the effectiveness of the simulator.

• Subsequent to the FOE, a special IPR will be held to determine if full fielding of the simulator should be initiated.

• Include the simulator in CTA 50-970.

• This correspondence accepts the item into the Army Inventory and transitions the management responsibility for the item to Weapon Systems Management Directorate, AMCCOM, Rock Island, Illinois."

*Now the Chemical Research, Development and Engineering Center
**Now the Research, Development, and Engineering Support Directorate

2.2. Technical.

Details of the XD approach initially pursued by CSL may be found in a report by Razulis *et al*.*

The system initially consisted of modifying the M256 so that a specific part of the sampler, e.g., the blister (HD) test spot, would give a positive color when activated by a change in pH, which causes the color of the pH indicator dye, thymolphthalein, to form. Table 1 describes the color change and the modifications needed for the change. A contract for fabricating 300 TRAINS sets (36 samplers each) was let. These sets were used in DT II/OT II and in a study of the system's shelf life. An XD program to meet the TDLR using butanethiol as a simulant was continued but subsequently abandoned.

Because the US Army Chemical School objected to the procedures for disposal of hazardous waste from the TRAINS, based on changes in EPA regulations, the simulator was modified. These changes will be discussed in Section 3.

3. TECHNICAL DESCRIPTION

3.1. Initial ED Design.

The initial design followed a concept proposed in XD, and reported by Razulis *et al*.* to modify the M256 Chemical Agent Detector Kit samplers to give a pre-engineered response. This modification was to change the various reactions used in the M256 to the minimum extent possible. The procedural steps required to operate or function the device were not altered.

The TRAINS Kit, as initially designed, consisted of 12 unmodified M256 samplers for a negative test (absence of agent) and 6 each for V/G, HD, AC, and CK to simulate positive (agent present) tests. Figures 1 and 2 present a view of the contents of the kit and the original instructions in the kit for the instructor's use. Figure 3 shows the sampler to be virtually identical to the M256 sampler. The only difference is a blue border around the outside of the sampler ticket and a "For Training Use Only" statement. Figure 4 shows the moisture vapor barrier bag for the sampler. In this case the only differences were a totally blue rather than olive drab color and a number such as T-400 to indicate to the instructor what the sampler was to simulate.

The initial changes to the chemistry of the M256 to obtain simulators are described in Table 1. An unmodified M256 or TRAINS T-400 is shown in Figure 5 to indicate physically where the changes were made.

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*Razulis, M.K., Packard, M.T., Strauch, L.D. Jr., and Silvestri, A. ARCSL-TM-81002. XD of a Training Device for the Detector Kit, Chemical Agent, M256. December 1980. UNCLASSIFIED Report.

Table 1. Pre-Engineered Sampler Data

Configuration	Sampler marking	Number of samplers per set	M256 part number	Chemical modification	Ampule data: M256 title	Ampule data: Amount solution	Ampule data: Solution composition
"All clear" or negative tests	T-400	12	D5-77-2216	None			
Positive nerve	T-401	6	C5-77-2015 Note 4	Omit impregnation with cholinesterase horse enzyme and gelatin			
Positive blister (mustard)	T-402	6	C5-77-2217-2 Note 10	Omit DB-3 and mercuric cyanide and replace with thymolphthalein	Methanol	0.2 ± 0.02 ml	0.02 gm thymolphthalien per 200 ± 0.1 ml methanol
Positive blister (phosgene oxime)	T-403	6	C5-77-2217-2 Note 10	Omit DB-3 and mercuric cyanide and replace with phenolphthalein	Methanol	0.2 ± 0.02 ml	0.025 gm phenolphthalein per 200 ± 0.1 ml methanol
Positive blood	T-404	6	C5-77-2217-3 Note 11	Add KCN to solution	Pyridine	0.4 ± .02 ml	0.80 gm KCN per 4.0 ± 0.1 ml of 4-benzylpyridine and 396 ± 1.0 ml of 2-methoxyethanol

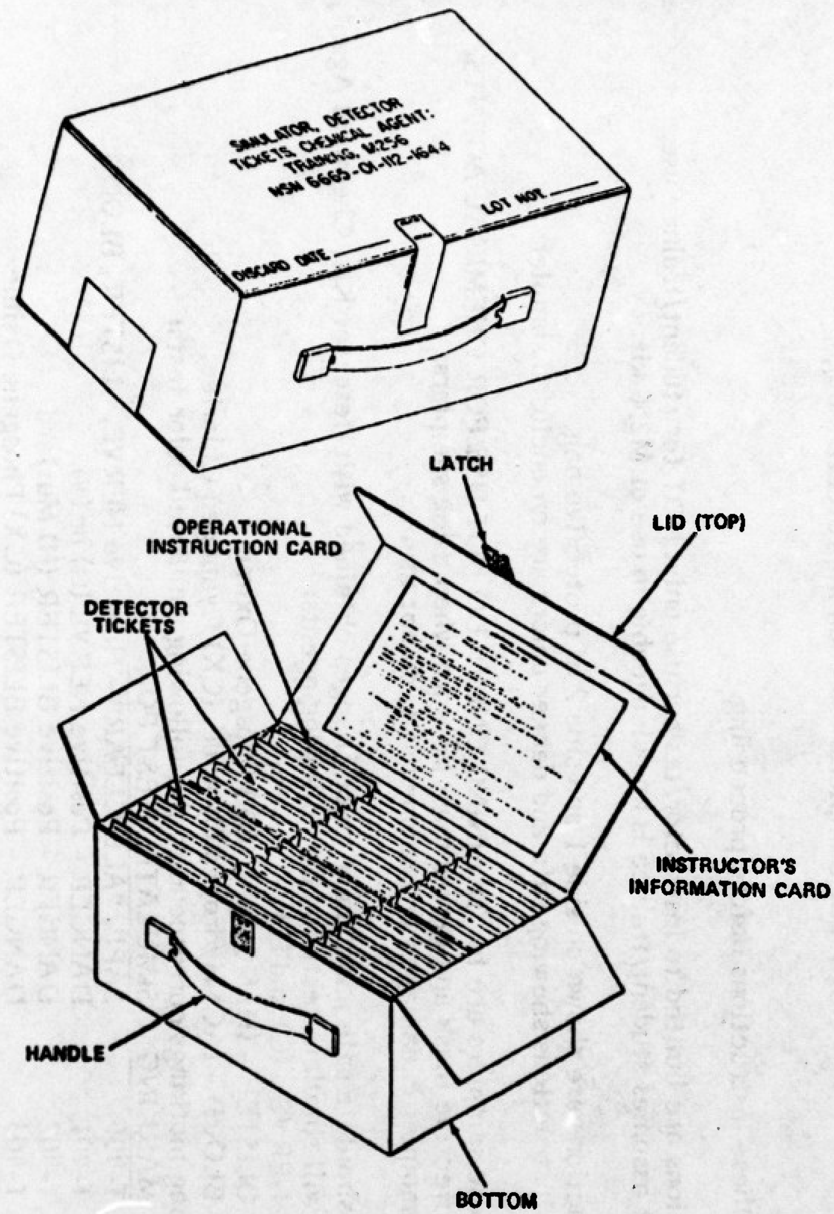

Figure 1. Simulator, Detector Tickets, Chemical Agent; Training M256

OPERATIONAL INSTRUCTIONS FOR
SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENTS: TRAINING, M256

Contents: Carrying box with handle
Training Samplers: 36 each in protective bag

GENERAL: Read these instructions before proceeding.

A. These instructions are limited to instructor/trainer use only; NOT for student/trainee use. Use of this set assumes student/trainee is knowledgeable in use of M256 kit.

B. Sampler instructions are shown on side 1 and side 2 of protective bag. Observational instructions showing safe and danger colors are on enclosed sampler.

CAUTION: 1. These samplers are for TRAINING ONLY: DO NOT USE FOR CHEMICAL AGENTS.
CAUTION: 2. Protective mask and gloves must be worn when using samplers.
CAUTION: 3. If sampler is damaged or becomes wet, do not use.

C. 1. Samplers simulate safe and danger color changes obtained with Detector Kit, Chemical Agent, M256.
2. Samplers will simulate tests for the following agents:
NERVE - (G) and (V)
BLISTER - (H) Mustard, (CX) Phosgene Oxime
BLOOD - (AC) Hydrogen Cyanide, (CK) Cyanogen Chloride.
3. Sampler/bag markings correspond to the following simulated color tests:

MARKING	SIMULATED TEST FOR
T-400	SAFE, "ALL CLEAR" - Negative NERVE, BLISTER, BLOOD.
T-401	DANGER - Positive NERVE (G) or (V)
T-402	DANGER - Positive BLISTER (H) Mustard
T-403	DANGER - Positive BLISTER (CX) Phosgene Oxime
T-404	DANGER - Positive BLOOD (AC) Hydrogen Cyanide or (CK) Cyanogen Chloride.

D. 1. Instructor decides agent/alert to be simulated.
2. Only one agent condition should be simulated at one time; agent types should not be mixed.

E. Entire sampler must be read within 3 minutes; then discard sampler.

Figure 2. Instructor's Information

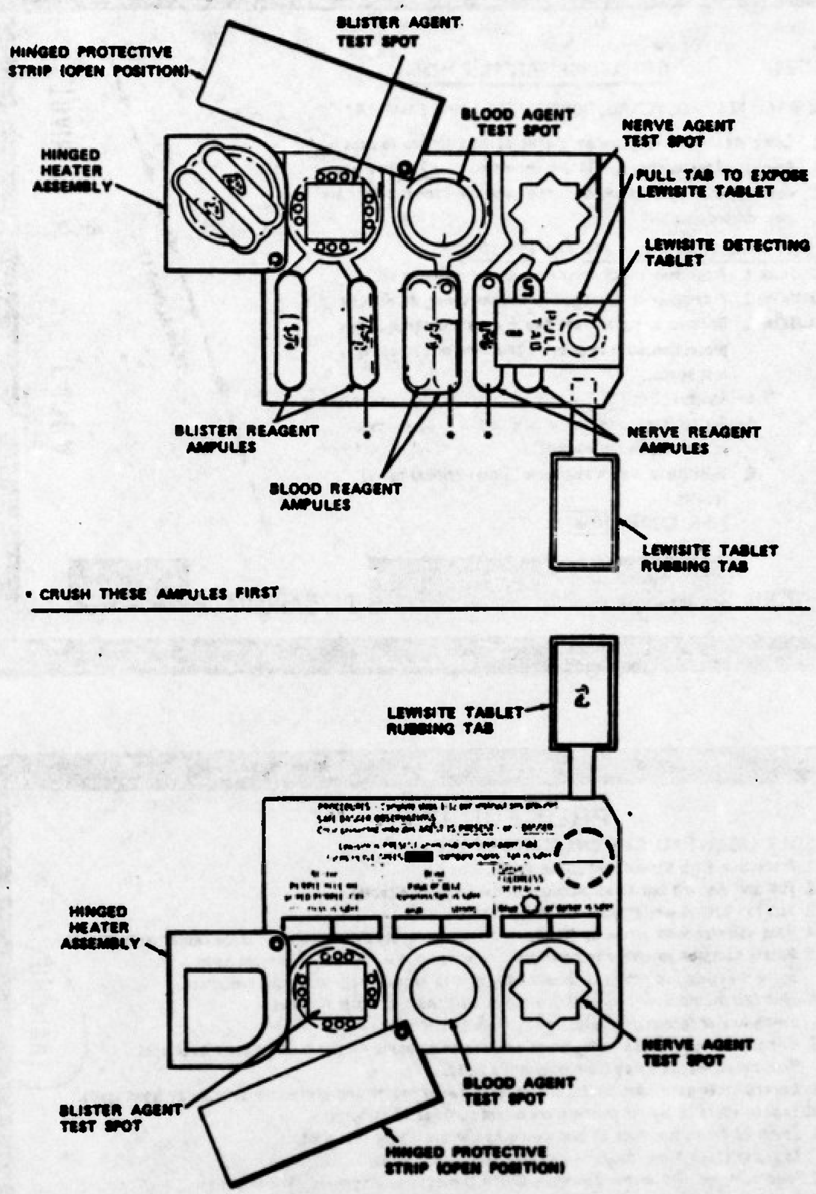

Figure 3. Sampler Detector (Protective Bag Removed)

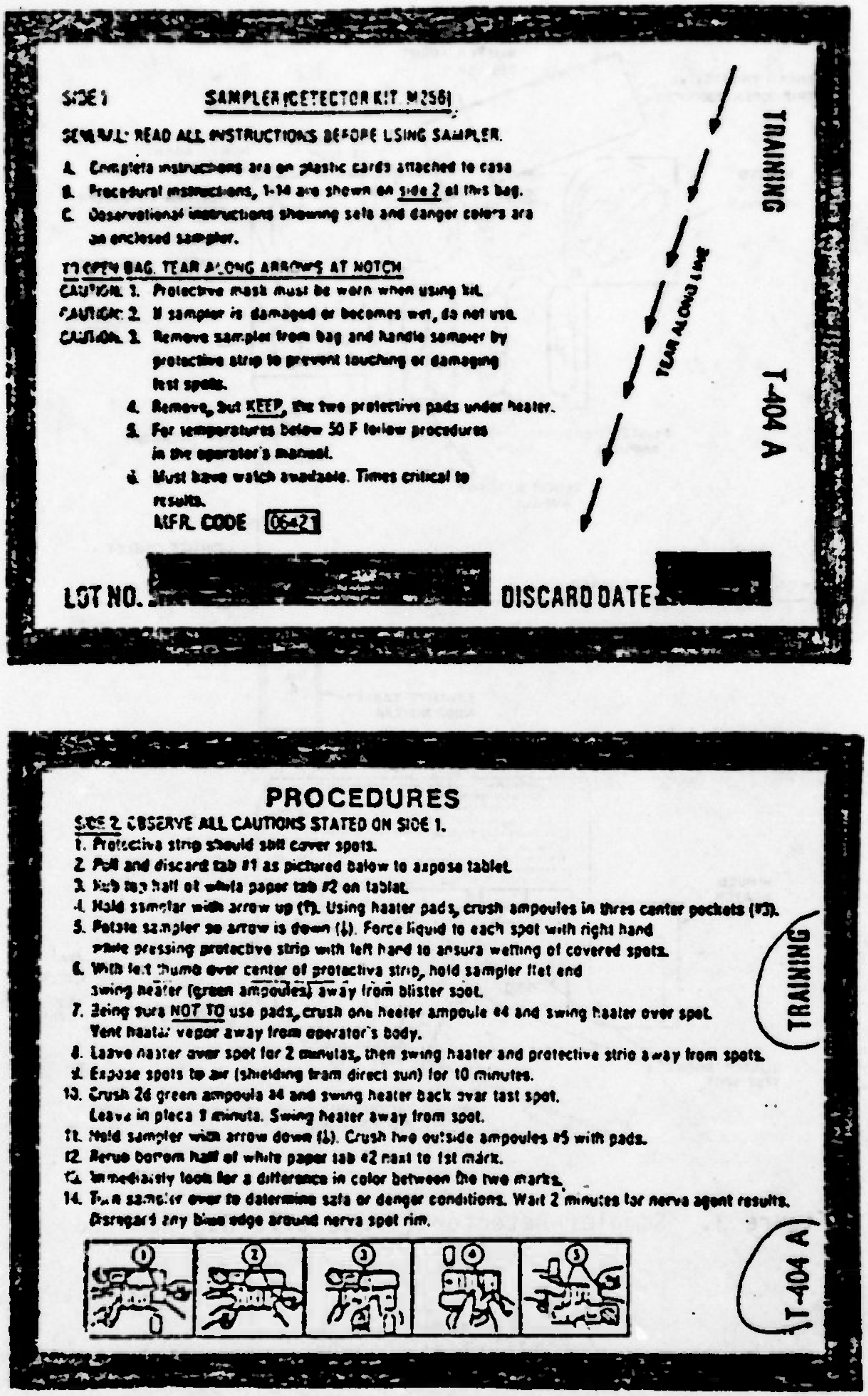

Figure 4. Marking and Coding of Training Sampler Bag

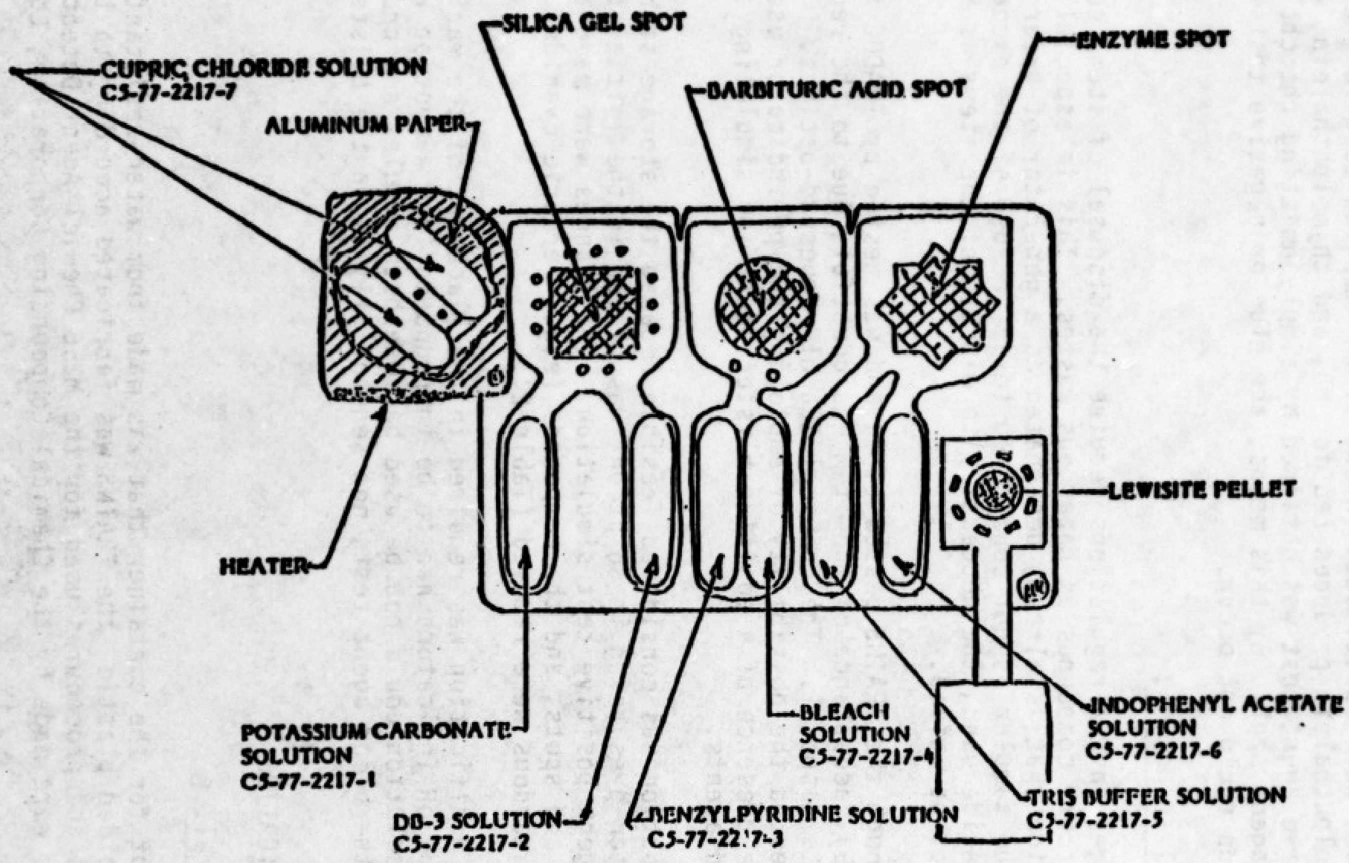

Figure 5. Chemical Content of TRAINS T-440 Samplers

No changes had to be made to the M256 to achieve negative or all clear tests. A positive blood agent test was provided by adding potassium cyanide to one of the solution ampules. This test would be considered a very close match to an actual AC test because the potassium salt of hydrocyanic acid (hydrogen cyanide) was used. For blister agent tests, pH indicators, phenolphthalein or thymolphthalein, were substituted in one of the ampules to give the desired colors. Phenolphthalein produces red for HD, and thymolphthalein, blue for CK. A positive nerve agent test was obtained by simply omitting the cholinesterase on the nerve agent spot. By this means, the blue or negative test caused by the enzyme's action could not occur.

3.2. Final ED Design.

Changes in EPA regulations require the disposal of items containing cyanide or mercury compounds as hazardous wastes. This is especially true at any installation that is already designated as a generator of hazardous wastes. Even though the sampler is not considered toxic because of the exceedingly small amounts of cyanide used, the neccessity to dispose of the items as hazardous waste could not be waived.

Although the TRAINS passed DT II and was tested by TRADOC in OT II (see section 5), acceptance of the item was doubtful, due to the requirement for hazardous waste disposal. The Chemical School requested options. The project engineer suggested the possibility of employing the pH indicator used for simulating the presence of a positive blister agent for simulating a positive test for blood agents.

The option was considered feasible because the storage stability of the pH indicator dyes, even in solution, was proven in the initial testing of the blister agent positive test simulation. The changes were made to the blood agent ampules and spots, and the compounds (e.g., mercuric cyanide) that were potentially hazardous were removed (Table 2).

Some modification was required in the placement of the various reactants. For example the pH indicators had to be impregnated into a spot on Whatman 40 paper. A solution could not be used because both ampules are crushed at the same time in the blood agent test, not sequentially as in the blister agent test.

4. FABRICATION

4.1. General.

Except for the container that was made from water-resistant fiberboard, rather than molded plastic, the TRAINS was fabricated according to the same specifications and procedures used for the M256 Chemicl Agent Detector Kit. All test items were made by the Chemical Compounding Corporation, Long Island, NY.

TABLE 2. CHANGES TO TRAINS T-400, 401, 402, 403, AND 404 SAMPLERS FROM DT/OT II TRAINS SAMPLERS

Sampler	Components	Blood	Blister
T-400	Ampules	Omit Benzylpyridine Solution and Bleach Solution	Omit K_2CO_3 Solution and DB3 Solution with Mercuric Cyanide
		Add MeOH (45 percent)/H_2O (55 percent)	Add MeOH (45 percent)/H_2O (55 percent)
	Spot	Omit Barbituric Acid/Omit Glass Microfiber Paper Add Whatman 40 Paper	No Change
T-401	Ampules	Omit Benzylpyridine Solution and Bleach Solution	Omit K_2CO_3 Solution and DB3 Solution with Mercuric Cyanide
		Add MeOH (45 percent)/H_2O (55 percent)	Add MeOH (45 percent)/H_2O (55 percent)
	Spot	Omit Barbituric Acid/Omit Glass Microfiber Paper Add Whatman 40 Paper	No Change
T-402 & T-403	Ampules	Omit Benzylpyridine Solution and Bleach Solution Add MeOH (45 percent)/H_2O (55 percent)	No Change
	Spot	Omit Barbituric Acid/Omit Glass Microfiber Paper Add Whatman 40 Paper	No Change
T-404	Ampules	Omit Benzylpyridine Solution, Potassium Cyanide, and Bleach Solution	Omit K_2CO_3 Solution and DB3 Solution with Mercuric Cyanide
		Add K_2CO_3 in H_2O	Add MeOH (45 percent)/H_2O (55 percent)
	Spot	Impregnate with Thymolphthalein/ Whatman 40 Paper	No Change
T-404A	Ampules	Omit Benzylpyridine Solution, Potassium Cyanide, and Bleach Solution	Omit K_2CO_3 Solution and DB3 Solution with Mercuric Cyanide
		Add K_2CO_3 in H_2O	Add MeOH (45 percent)/H_2O (55 percent)
	Spot	Omit Barbituric Acid/Omit Glass Microfiber Paper	No Change
		Impregnate with Phenolphthalein/ Whatman 40 Paper	No Change

Changes to TRAINS Sampler-Detector Package: Use the same color and printing used on the M256 Moisture Vapor Barrier Bag on the TRAINS Moisture Vapor Barrier Bag except for a ¼ inch wide dark blue border around the whole item on both sides.

4.2 Technical Data Package.

The Technical Data Package (TDP) for the M256 Chemical Agent Detector Kit was modified, where necessary, to include information for the TRAINS item. A complete TDP for the TRAINS was prepared with all proposed engineering changes incorporated. All drawings and specifications were formally entered into the Configuration Control S, tem.

5. TESTING

5.1 Test of System Shelf Life and Storage Management.

To determine the shelf life of the TRAINS, a test of system shelf life and storage management was performed under the direction of Product Assurance Directorate. These tests showed that the TRAINS had a minimum shelf life of 5 years (Appendix C).

5.2 EDT/DT II.

Because the TRAINS was basically achieved through a series of comparatively simple changes in a type-classified item, TECOM agreed to allow the test to be performed at CSL by the Development Support Division. TECOM had final approval of the test plan and report. An observer from DPG was present and TECOM prepared an IER (Appendix D). The Product Assurance Directorate prepared a Reliability, Availability, and Maintainability (RAM) assessment (Appendix E).

The IER for DT II recommended the TRAINS be accepted in the Army Inventory as a stock-funded item and entered into the production phase of development.

5.3 OT II.

An OT II was successfully completed by TRADOC, as stated earlier. Several problems were uncovered in the test, as reported in the IER by the Chemical School. The main problem was the presence of small amounts of potassium and mecuric cyanide in the samplers. These were subsequently removed, and different chemical techniques were used to simulate positive agent tests. The small amounts of cyanide, while not toxic, did necessitate the collection of samplers and their treatment as hazardous waste near the end of the ED phase. A follow-on evaluation was performed in the production phase to assure that no problem or degradation had occurred due to the changes in the samplers.

6. CONCLUSION

An accelerated engineering development phase was executed successfully for the Simulator, Detector Tickets, Chemical Agent: Training, M256. No advanced development phase was required. The device was accepted into the Army Inventory as a stock-funded item, pending some additional follow-on evaluation in the production phase.

APPENDIX A

TRAINING DEVICE LETTER REQUIREMENTS

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TRAINING DEVICE LETTER REQUIREMENT

for

Training Device for Detection Kit, Chemical Agent, M256

established by

Commander, US Army Training and Doctrine Command

and

Commander, US Army Materiel Development and
Readiness Command

1. The undersigned agree that a program should be initiated forthwith to meet the requirement as specifically outlined in the inclosure. Validated cost data has been provided in the TDLR.

2. The TDLR is subject to review at any time but annually as a minimum, at the request of either cosignatory.

1 Incl
as

CARL E. VUONO
Major General, GS
Deputy Chief of Staff
for Combat Developments
Date 20 Jun 80

STAN R. SHERIDAN
Major General
Director for Development
and Engineering
Date 28 Nov 80

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TRAINING DEVICE LETTER REQUIREMENT (TDLR)
FOR A TRAINING DEVICE FOR THE DETECTION KIT,
CHEMICAL AGENT, M256

1. Title of the Item. Training Device for the Detection Kit, Chemical Agent, M256.

2. Statement of the Need.

a. There is a requirement to train both the individuals and units of the Army to survive in a chemical warfare environment. To satisfy this requirement, soldiers must be trained in the correct use of chemical agent detection equipment in order for them to recognize when they are in (or not in) a toxic chemical agent hazard environment. A need exists for a training device for the M256 Chemical Agent Detection Kit which will simulate the detection of toxic chemical agents. This training device will be used during integrated field training exercises to detect the presence of approved training simulant agents and to familiarize personnel with the proper doctrine of use of the M256 Chemical Agent Detection Kit.

b. CARDS Reference Number: 1206R

3. Justification.

a. Currently, practical hands-on chemical defense training is of a very limited scope since the "station" concept is normally employed. In this framework, the trainee becomes familiar with the mechanics of individual items of chemical defense equipment; but rarely does he receive effective training in how these individual items of equipment interact together to provide total chemical protection. The upcoming fielding of the new Office of The Surgeon General (OTSG)-approved persistent and nonpersistent training simulants along with the associated dissemination devices can greatly upgrade the effectiveness of integrated chemical defense training exercises. However, the M256 Chemical Agent Detection Kit will not detect field concentrations of any of the approved training simulant agents. Furthermore, the simulant agent research programs currently underway are not likely to yield any new OTSG-approved simulants in the near future that will activate the M256 Chemical Agent Detection Kit. A training device for the M256 Chemical Agent Detection Kit which will detect the presence of simulant agents in the field will be a valuable tool for the integrated training exercise planner in creating a total training environment in which individual soldiers and units of the Army can become proficient in chemical defense procedures.

b. This training device supports the NBC Common Tasks, 031-501-3001, Test for Chemical Agents Using A Chemical Agent Detection Kit, TRADOC Circular 351-1, Common Job and Task Management System. This Common Task

pertains to all MOSC. This training device also supports collective tasks in the standard NBC Defense Module for ARTEP, TRADOC Regulation 310-2, Preparation of Army Training and Evaluation Program (ARTEP).

4. Basis of Issue. The Training Device for the M256 Chemical Agent Detection Kit will be listed in CTA 50-900 series. They will be issued to support TRADOC service schools, post/division NBC schools, unit training and the USAREUR NBC Defense School. It has been determined that approximately 2,052,350 training devices will be required per year to support training.* This is based on the following tentative distribution schedule:

Training Activity	Per Exercise/Course/Unit	Total/Year
Service Schools		
Officer and NBC Courses		
USAIC	4 ea exercise per course	650
USAFAS	4 ea exercise per course	850
USAARMC	4 ea exercise per course	450
USAADS	4 ea exercise per course	150
USACMLS	4 ea exercise per course	400
Other	4 ea exercise per course	500
AIT/MOS-Producing Courses		
USACMLS	40 ea exercise per course	2,400
Post/Div NBC Schools	4 ea exercise per course	1,500
USAREUR NBC and Brigade NCO Defense Schools	4 ea exercise per course	600
Unit Training Company**		
Active	27 ea per field training day (16 field training days/year)	1,036,800

* A training device is defined as one chemical agent detector ticket training equivalent. Twelve detector ticket training devices, one packet of standard ABC M8 Chemical Agent Detector Paper, and an instruction packet comprise one M256 Chemical Agent Detection Training Kit.

** For units larger than company -- requirements will be based on company requirements times the number of company-size units being trained.

Training Activity	Per Exercise/Course/Unit	Total/Year
Reserve and National Guard	27 ea per field training day (8 field training days/year)	864,000
Separate Platoon, Detachment, or Platoon-	9 ea per field training day (16 field training days/year)	144,000

5. Principal Characteristics. The M256 Chemical Agent Detection Kit Training Device:

a. Shall be identical in physical appearance and characteristics to the M256 Chemical Agent Detection Kit, except that its packaging, as well as the detector itself, shall be blue or marked with blue to identify it as a training item.

b. Shall be capable of detecting and responding to achievable field concentrations of OTSG-approved training simulants. The training device and augmenting simulants shall provide a realistic range of responses consistent with the detection capabilities of the M256 kit.

c. Shall be capable of operation and storage in the basic climatic design type as delineated by AR 70-38. The training device for the M256 kit will preferably exhibit the same inherent problems that accompany cold-weather operations as the M256 kit; i.e., the difficulty of getting two reactions to occur at low ambient air temperatures.

d. Shall be capable of engineering modification that will adapt it for use with developmental simulant agents that become OTSG-approved. Any developmental simulant agent for potential OTSG approval is required to have a chemical reaction that will enable it to be detected. This requirement is part of the Phase III Training Systems Program.

e. Shall have a shelf life at least as long as the M256 Chemical Agent Detection Kit (5 years).

f. Shall have a probability greater than or equal to .90 that it will detect approved chemical agent simulants with vapor pressures that produce detectable vapor concentrations at least 15 meters downwind from the line of dissemination for at least 10 minutes after dissemination when the simulant is disseminated in wind speeds between 3 and 15 knots and temperatures between 20 and 100 degrees F.

g. Shall be safe (nonhazardous) when used properly in troop training exercises. Potential health hazards will be addressed during all phases of development and testing.

h. Shall be constructed of materials that do not provide a toxic disposal problem.

i. Preengineered devices which will result in positive color tests without the presence of agent simulants will be considered as possible interim training devices.

6. Testing Required.

a. Developmental Testing (Physical and Safety Tests). Testing will be conducted at US Army Test and Evaluation Command at Aberdeen Proving Ground and other locations to verify functioning in climatic extremes, transportability, storage life, and other physical properties.

b. Operational Testing. An operational test (OT) will be conducted to validate the utility of the training device for the M256 Chemical Agent Detection Kit. To be included in the OT will be a verification test of color change and an evaluation of comprehension of the color change. Individuals involved in the testing would be screened to insure that they are not color-blind.

c. Milestones:

	ED	Oct 80
	OT	May 81
	IPR/TC	Oct 81
	IOC	Apr 83

7. Logistic Support Implication. The Training Device for the M256 Chemical Agent Detection Kit will be an expendable, nonreportable, nonrecoverable item; and thus will impose no special logistical support consideration. Transportation and storage will be handled analogous with the standard M256 Chemical Agent Detection Kit.

8. Training Assessment.

a. Qualitative and Quantitative Personnel Requirements Information. The Training Device for the M256 Chemical Agent Detection Kit will be used by personnel charged with the responsibility to conduct chemical contamination reconnaissance. There will be no special personnel requirements.

b. New Skills and knowledge. None required.

c. Contract Assistance. None anticipated.

d. Training Support Implications. No new equipment training is required. Training manuals will be provided, if applicable; however, Skill Performance Aids (SPAS) format is not required.

9. Manpower/Force Structure Assessment. The training device for the Chemical Agent Detector Kit will be used by personnel charged with the responsibility to conduct NBC integrated field training exercises. There will be no special requirements for Manpower/Force Structure Changes.

10. Other Service or Allied Nation Interest. Coordination is being conducted through DCSCD, TRADOC for Phase II coordination with ABCA countries and appropriate allied nations.

11. Life Cycle Cost Assessment. Attached as Incl 1.

ANNEX A - Coordinations
ANNEX B - CTEA
ANNEX C - Rationale
ANNEX D - RAM Rationale

Training Set for the M256 Detection Kit, Chemical Agent

a. Summary of estimated life cycle costs as expressed in constant FY 80 dollars and current (inflated) ($M-Millions).

	Constant Dollars			Current Dollars		
	Low	Most Likely	High	Low	Most Likely	High
R&D	0.333	0.350	0.385	0.360	0.379	0.417
Investment	2.192	2.307	2.538	2.572	2.707	2.978
Total	2.525	2.657	2.923	2.932	3.086	3.395

NOTE 1: Quantity of Prototypes: 10,800 Samplers (300 sets)

NOTE 2: Sunk Costs: No R&D development (6.3, 6.4) has been done on this item.

NOTE 3: No ARRCOM operating and support (O&S) costs are submitted due to the expendable, first line operation/maintenance nature of the set; the exclusion of command-level integrated logistics support costs not reasonably indentified/allocable to the set (see para 2-7C, DA Pamphlet 11-4, Apr 76); and the assumption that the scenario for training center and TOE unit troop utilization of the set is a TRADOC responsibility.

NOTE 4: A 5 percent low estimate is projected based on the relatively simple technology.

NOTE 5: A 10 percent high estimate is projected as a consequence of inflation due to delay in funding of the program.

b. Quantity of items costed in FY 80 dollars:

Item	Quantity	Unit Flyaway	Unit Procurement
Sampler	552,350	$4.18	$4.18

c. Recommended funding profile expressed in constant FY 80 dollars and current (inflated dollars ($M-Millions).

R&D Phase	FY 81	FY 82	FY 83	FY 84	Total
Approved Program (Current)	--	--	--	--	--
Estimate (Current)	0.372	0.007	--	--	0.379
Estimate (Constant)	0.344	0.006	—	--	0.350

Investment Phase	FY 81	FY 82	FY 83	FY 84	Total
Quantity		0.552			
Approved Program (Current)	--	—	--	--	--
Estimate (Current)	--	2.619	0.084	0.004	2.707
Estimate (Constant)	—	2.237	0.067	0.003	2.307

NOTE 1: Source document for quantity is TDLR for a Training Device for the Detection Kit, Chemical Agent, M256, 28 Jan 79. Quantity is based on 25 percent of the first year's requirement. This is based on projected first production capability to make the items.

NOTE 2: Inflation has been incorporated in accordance with DRCCP-ER, 17 Sep 79, Guidance for Inflation of Cost Estimates.

NOTE 3. Cost estimates is for pre-engineered concept for device. Cost estimates for full requirement will be developed as exploratory development proceeds.

VALIDATED

CONTROL NO: 675 LEVEL NO: II

AUTOVON: 584-1262 DATE: 10/4/79

VALIDATOR: [illegible]

CODE: [illegible]

ANNEX A

COORDINATION

COMMAND	COMMENTS RECEIVED	COMMENTS ACCEPTED	COMMENTS NOT ACCEPTED
CINC, USAREUR	1	1	0
CDR, FORSCOM	3	1	2
CDR, TECOM	2	2	0
CDR, EUSA	2	2	0
CDR, USAICS	0	0	0
CDR, USA Log Cen	4	4	0
CDR, USAMMCS	1	1	0
CDR, USA Avn Cen & Ft Rucker	0	0	0
Cdr, USAMP&CS/TC & Ft McClellan	0	0	0
CDR, USA CA Cen & Ft Leavenworth	3	2	1
CDR, TRADOC	10	10	0
CDR, USATSC	14	14	0
CDR/DIR, CSL	6	1	5
COMDT, USAIS	2	0	2
COMDT, USAADS	0	0	0
COMDT, USAFAS	0	0	0
COMDT, USAQMCENFL	0	0	0
COMDT, USATSCH	0	0	0
COMDT, USAARMS	0	0	0
COMDT, USASIGS	0	0	0
CDR, USALEA	0	0	0
DIR, AMSAA	7	3	4
DIR, USAEARA	0	0	0
SUPT, AHS, USA	2	2	0
PM TRADE	0	0	0
	57	43	14

RATIONALE FOR NONACCEPTANCE

1. Commander, US Army Forces Command:

a. Comment: Page 2, paragraph 4 - In order to avoid confusion, recommend that basis of issue be one Chemical Agent Detection Training Kit per M256 authorized.

Rationale: The Training Device for the M256 Kit will be used in field exercises only. The M256 Kit will be used for classroom training

(in conjunction with the M7242 SCAITS Kit). Therefore, the Training Device for the M256 Kit would be authorized independently from the basis of issue plan for the M256 Kit.

b. Comment: Calculations concerning use of this device for unit training should be based on the number of M256 Kits authorized. For initial planning purposes, it is recommended that basis of issue be one training kit per M256 Kit authorized with an annual replacement factor of one for active components and .5 for reserve components.

Rationale: The Training Device for the M256 Kit will be used in field exercises only. Sixteen days of integrated chemical training per year for active duty companies (separate platoons, detachments, or platoon size units), has replaced the rate of two training days per year. For Reserve and National Guard units, eight field training days per year replaced the rate of one field training day per year. Consequently, the total number of M256 Training Devices needed per year has been changed.

2. US Army Combined Army Center & Fort Leavenworth:

Comment: Page 3, paragraph 5f - Recommend that the stated relisbility performance characteristic parameters of the M256 Training Device be identical, or as close as possible, to those of the M256 Chemical Agent Detection Kit.

Rationale: The Reliability performance characteristics of the Training Device for the M256 Kit are based on the probability that the Training Device will detect approved Chemical Agent Simulants. Those stated parameters are identical to the performance parameters that chemical agent simulants must meet before approval.

3. Commander/Director, Chemical Systems Laboratory:

a. Comment: Page 3, paragraph 5d - Delete this paragraph in its entirety. It is an over-simplification to suppose that by a simple engineering change, one detector may be converted to a detector for a new simulant. Even if a new simulant is provided with a chemical test, chemical design changes, reliability, interference, storageability and compatibility with the M256 Detection Kit design would have to be investigated. In summary, a new simulant would require development of a new detector.

Rationale: This paragraph is intended to impart the importance of the Training Device modification or improvement subsequent to OTSG approval of the new training simulants.

b. Comment: Page 3, paragraph 5e, line 2 - Change "(five years)" to read "(two years)."

Rationale: A five-year shelf life is necessary to prevent any possible loss of detectors due to expiration.

c. Comment: Page 3, paragraph 5f, line 2 - Change to read " ---- approved nonpersistent chemical agent ------". Persistent training agents would not have sufficient vapor pressure to produce high vapor concentrations.

Rationale: The terms "nonpersistent" and "persistent" should not be used to classify training simulants. Persistency is a characteristic that a simulant may have, but to classify a compound as either persistent or nonpersistent is invalid. Example: A persistent compound at 25°c may become nonpersistent at elevated temperatures. The paragraph indicated has been reworded to account for vapor concentration dependency upon vapor pressure.

d. Comment: Annex D, paragraph 1b(5) & (6) - Delete these three uses. The efficacy of the M256 Kit in these modes has not yet been demonstrated.

Rationale: Those uses stated are identical to those stated for the M256 Kit. At the present time, there is no piece of equipment in the inventory other than the M256 Kit which is available to accomplish the fight missions which are listed in the TDLR. Therefore, it is imperative that the Training Device of the M256 Kit be used in Field Training Exercises in order to familiarize personnel with the proper doctrine concerning the use of the M256 Kit and any subsequent actions dictated by the particular mission.

e. Comment: Annex D, paragraph 1b(8) - Delete this use. Since only one simulant is available, the ability of the training device to classify cannot be demonstrated.

Rationale: The training device for the M256 Kit will be used in field training exercises to train personnel to classify any agent detected according to the color change observed on the detector ticket. At the present time the training device for the M256 Kit will only detect one simulant, yet troop personnel utilizing the Kit must still classify the simulant detected according to the observed color change.

4. Commandant, US Army Infantry School:

a. Comment: Page 3, paragraph 5c, line 3 & 4 - Delete "preferable exhibit the same inherent problems that accompany cold-weather operations."

Rationale: It is essential that the Training Device for the M256 Kit simulate, as much as possible, the actual M256 Chemical Agent Detection

Kit - to include any inherent problems. If the training device was to prove operational under conditions where the actual kit was not operational, this would lead to a false confidence in the actual kit.

b. Comment: Page 5, paragraph 9: Change "There will be no special ......" to read "There will be no special maintenance, supply, personnel, or transportation requirements."

Rationale: In accordance with TRADOC Circular 70-1, Appendix F Training Device Letter Requirement (TDLR), paragraph 9 of a TDLR will ".... address the need for operator and maintenance personnel training..."

5. Director, US Army Materiel Systems Analysis Agency:

a. Comment: Page 1, paragraph 3 - It is recommended that development of a training simulant which activates both the M8 Alarm and the M256 Kit needs to be initiated. Such a simulant should be nontoxic, environmentally acceptable and safe (approved by the Surgeon General).

Rationale: Research on training simulants is a continuous project. Development of a new training simulant which will activate both the M8 and the M256 and which will be OTSG approved is not likely to occur anytime in the near future.

b. Comment: Page 1, paragraph 3 - "The concept of fielding a new piece of equipment instead of accelerating simulant development needs to be examined."

Rationale: The concept of fielding a new simulant has been evaluated and is not considered to be within the current state-of-the-art.

c. Comment: Page 2, paragraph 4 - It is believed that the BOI is too conservative with respect to unit training.

Rationale: The BOI represents the best available estimate by the Chemical School of the quantities to be used. The BOI will be reviewed after fielding.

d. Comment: Annex D, paragraph 1b(6) - Delete "Completeness of Decontamination."

Rationale: It is the intent of the materiel developer to modify the kit instruction card and operators manual for the M256 Kit to indicate the false positive responses might occur if the sampler is exposed to STB powder or bleach. At the present time, the only item in the Army inventory that is available to check for contamination (including any residual contamination after any decontamination operations) is the M256 Kit. Currently, a two pronged developmental approach is being employed in

addressing this problem. The first of these is the ACADA which specifics an automatic device for detecting contamination density of surfaces. The ACADA requirement document has been prepared and approved. The second project is currently being initiated. This involves a literature research search and the establishment of threshold contamination densities for surfacës. Suggest that AMSAA assist in establishing threshold contamination densities.

COST AND TRAINING EFFECTIVENESS ANALYSIS

1. PURPOSE: The purpose of this report is to determine the potential cost and training effectiveness of the Training Device for the Detection Kit, Chemical Agent, M256; a device that will be used by institutions and units to detect the presence of approved training simulant agents and to familiarize personnel with the proper doctrine of use of the M256 Chemical Agent Detection Kit.

2. BACKGROUND: At the present time, US Forces are encountering difficulties in conducting realistic NBC defense training. Such training is required to give the soldier an appreciation of the characteristics of actual chemical agents and of the capabilities associated with his chemical defense equipment. Within the current terms of reference, live agent training cannot be conducted. Yet, previous experience at the US Army Chemical School indicated that live agent exercises were very motivating to students and that the teaching points demonstrated in these exercises were remembered by students for extended periods. Several agents have been developed and approved for use in training that simulate live toxic agents. Yet, when these agents were evaluated in field trials, it was found that these simulants did not activate unit alarms or produce appropriate responses in detector kits. The Improved Chemical Defense System for Battalion-Size Units(U), Volume III, 1976, identified 13 critical training tasks. The training device described in this TDLR is directed at satisfying one of the 13 tasks: to exercise the chemical agent detection teams through the activation of the M256 Chemical Agent Detection Kit by approved training simulants.

3. OBJECTIVES:

a. Estimate the pertinent costs of each training alternative.

b. Estimate the potential training effectiveness of each training alternative.

4. SCOPE: This report covers the preliminary analysis performed to determine the cost and training effectiveness analysis of the Training Device for the Detection Kit, Chemical Agent, M256.

5. ASSUMPTIONS: The Training Device for the M256 will safisfy the requirements of the TDLR.

6. ESSENTIAL ELEMENTS OF ANALYSIS:

a. What are the costs associated with each training alternative?

b. What is the capability of each training alternative to provide effective training in the usage of the M256 Chemical Agent Detection Kit in an NBC integrated field training situation?

c. What is the capability of each alternative to provide for realistic NBC training?

d. What is the most cost effective choice to teach the usage of the M256 Chemical Agent Detection Kit in a field situation?

7. ALTERNATIVES:

a. NBC integrated filed training without the Training Device for the M256 Chemical Agent Detection Kit.

b. NBC integrated field training with the Training Device for the M256 Chemical Agent Detection Kit.

8. TRAINING ALTERNATIVE CAPABILITY ANALYSIS: Simulant activation of the M256 Chemical Agent Detection Kit has been identified as a critical task in the Improved Chemical Defense System for Battalion-Size Units (U), Volume III. Therefore, the first alternative, which describes the situation under which we are currently conducting training does not provide for effective training. Yet, the second alternative would not only provide for effective training in the usage of the M256 Chemical Agent Detection Kit, but would also allow for more realistic field training.

9. COST METHODOLOGY:

a. The cost estimate for the Training Device for the M256 Chemical Agent Detection Kit as provided by Chemical Systems Laboratory, will be used as the basis for the cost of subject Training Device.

b. The material developer has stated that preengineered samplers, which when placed into operation yield positive color tests without the presence of agent simulants, are technologically feasible and could be fielded in two years.

c. Capability analysis indicated that a simulant activated device will not be fielded until 1985. In an attempt to enhance realistic integrated field training, the USACMLS has determined that such preengineered samplers are acceptable as interim training devices.

10. COST ANALYSIS: The unit procurement cost for each training device for the Detection Kit, Chemical Agent, M256 is $4.18 in FY80 dollars, based upon a total quantity to be produced of 552,350 kits.

11. NONQUANTIFIABLE BENEFITS: Nonquantifiable benefits can be realized by the use of the Training Device for the M.256 Chemical Agent Detection Kit in integrated training in a field environment. The use of this training device will provide for realistic training. At the present time there is no methed of realistically simulating the arrival and detection of chemical agents. Having troops "pretend" that their M256 Detector has detected a chemical agent in the air, or operate their M256 Samplers over small bottles of simulant are unacceptable training techniques. The subject training device will alleviate these problems and provide for realism in field training.

12. CONCLUSION: The use of the Training Device for the Chemical Agent Detection Kit would fill a critical training void if adopted for use.

13. RECOMMENDATION: Development and fielding of the Training Device for the M256 Chemcial Agent Detection Kit be accomplished as soon as possible.

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APPENDIX B

REPORT OF ENGINEER DESIGN TEST (DT) FOR SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENT TRAINING: M256

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MATERIEL EVALUATION BRANCH
DEVELOPMENTAL SUPPORT DIVISION
CHEMICAL SYSTEMS LABORATORY
ABERDEEN PROVING GROUND, MARYLAND 21010

Report of Test

Engineer Design Test (DT II)

for the

Simulator, Detector Tickets, Chemical Agent:

Training, M256 (TRAINS)

(EDT No. 209)

DRDAR-CLJ-M 26 January 1982

1. OBJECT

The object of this test effort was to provide data to evaluate the Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) in regards to its compliance with its Training Device Letter Requirements (TDLR).

2. AUTHORITY

Authority for conduct of this support testing is derived from the assigned mission of Materiel Evaluation Branch which includes the testing of items under development by Chemical Biological (CB) Detection and Alarms Division of the Chemical Systems Laboratory. This test effort was undertaken in support of the current RDTE program numbered 1M46725-D0-20-2X.

3. BACKGROUND

CB Detection and Alarms Division, Chemical Systems Laboratory, is currently involved in a development program for a training device which provides a method for realistically simulating the use and detection responses of the M256 Chemical Agent Detector. The device, which is nicknamed TRAINS (for Training Simulator Set), is pre-engineered to give simulated detection responses without the presence of chemical agents or chemical agent simulants which makes the item especially suitable for field training exercises.

Development of the TRAINS is being accomplished through an accelerated development program by which TRAINS proceeded into the Full Scale Engineering Development Phase immediately following the Exploration of Alternative Systems Concept Phase. To further expedite the program, the concept of a Chemical Systems Laboratory Engineer Design Test (EDT) program to fulfill the requirements for DT II of the TRAINS was agreed to in principal in the initial meeting of the informal TRAINS TIWG held 28 November 1980. An EDT Plan was developed by Materiel Evaluation Branch and submitted to TECOM for their review. Response from TECOM confirmed that the EDT Plan was adequate for use as the Independent Evaluation Plan/Test Design Plan (IEP/TDP) for TRAINS DT II.

The EDT was conducted in its entirety at the Chemical Systems Laboratory. Functional Efficiency Tests (paragraph 5.5) were monitored by the Dugway Proving Ground Test Officer assigned to the TRAINS program. Additional test data was acquired by a System Shelf Life Test conducted by the ARRADCOM Product Assurance Directorate at Aberdeen Proving Ground. The System Shelf Life and Storage Management Test Report is included as Appendix C of this report.

4. DESCRIPTION

The Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) consists of an assortment of 36 sampler-detectors to simulate positive nerve, mustard, phosgene oxime, and blood agent responses and negative "all-clear" responses expected from the actual M256 sampler-detector. The TRAINS utilizes M256 sampler-detectors that have been pre-engineered to give positive simulated chemical agent detection responses when activated without the presence of agent or agent simulants. TRAINS sampler-detectors are identical in physical appearance and operating characteristics to the standard M256 sampler-detector except that they are coded both numerically and with a blue coloration to designate them as training items. The set consists of 36 sampler-detectors of which 12 are authentic M256 sampler-detectors for a simulated "all clear" or negative responses and 24 are pre-engineered for simulated positive or "danger" responses (six each for nerve, mustard, phosgene oxime, and blood). Markings on the sampler-detector and its foil envelope correspond to the simulated response as shown below:

Marking	Simulated Test For
T-400	SAFE, "All Clear", Negative Nerve, Blister, Blood
T-401	DANGER, Positive Nerve (G) or (V)
T-402	DANGER, Positive Blister (H) Mustard
T-403	DANGER, Positive Blister (CX) Phosgene Oxime
T-404	DANGER, Positive Blood (AC) Hydrogen Cyanide or (CK) Cyanogen Chloride

Each sampler-detector is packaged in a blue, sealed, plastic-laminated bag with 36 of these packed in a blue, water resistant, fiberboard box approximately 11-3/4 inches X 7-1/2 inches X 5-3/8 inches. The carrying box is one piece with an attached cover held in place with a Velcro fastener and with a carrying handle on the front. Simple instructions for the instructor/trainer are fastened to the inside of the box cover.

5. TEST RESULTS

Forty-two (42) TRAINS kits, each with its full complement of 36 sampler-detectors, were submitted for testing as described below.

5.1 Receipt Inspection

All of the test items were subjected to a pre-test inspection to determine their suitability for use in this test program. No damage or significant imperfections were found during the examination. All of the test kits were then serialized for test identification purposes and distributed to the appropriate areas for testing.

5.2 Rough Handling

Six TRAINS kits were subjected to sequential rough handling treatment as described in paragraphs 5.2.1, 5.2.3 and 5.2.4 below.

5.2.1 Vibration-Secured Cargo

Three of the kits submitted for rough handling were temperature preconditioned at -30°F while the remaining three were preconditioned at +145°F. The preconditioning time was 24 hours in both cases. Following temperature preconditioning, the test kits were secured to a vibrator table and subjected to high frequency vibration to simulate being transported as secured cargo. The test was conducted in accordance with MIL-STD-810C, Method 514.2, paragraph 4.6.11, Procedure X. Following completion of the subtest, the test kits were visually examined and no damage was found which could be attributed to this vibration test.

5.2.2 Vibration-Loose Cargo

The same kits used in paragraph 5.2.1 were again placed in their respective conditioning temperatures for 24 hours. After this 24 hour period, the test kits were then subjected to a loose cargo bounce test. The test was conducted in accordance with MIL-STD-810C, Method 514.2, paragraph 4.6.12, Procedure XI, Part 2 except that the kits were returned to their respective conditioning temperatures overnight between successive one-half hour periods.

Following completion of this subtest, the test kits were visually examined and no damage was found which could be attributed to this vibration test.

5.2.3 Five Foot Drop

The same TRAINS kits used previously in paragraphs 5.2.1 and 5.2.2 were again placed in their respective conditioning temperatures for 24 hours. After temperature conditioning, the test kits were subjected to a five foot drop test. Each kit was dropped from a height of five feet so as to strike a steel plate embedded in concrete. Each kit was released so as to impact in the following attitudes: (a) bottom down, (b) top down, (c) side down, (d) end down, and (e) corner down.

Following completion of this subtest, the test kits were visually examined and only minor damage was noted. The damage to the kit was limited to slightly crumpled corners of the container boxes where corner impact had occurred. Insignificant damage to the box resulted from drops at other attitudes.

The individual sampler-detectors of these kits that were subjected to rough handling were removed from their protective envelopes and inspected for damage as part of Functional Efficiency Tests (paragraphs 5.5.1 and 5.5.2). Damage noted which may have been a result of rough handling treatment was one sampler-detector with a leaking ampoule (#5) and two other sampler-detectors with torn blister spots. All three damaged sampler-detectors were from test kits that were conditioned at +145°F. One sampler-detector (cold conditioned) was found to have an empty ampoule. Since the ampoule did not appear to be broken and no indication of leaking was noticed, it was determined that this was not caused by the rough handling treatment. Following the drop tests, the kits were submitted for functional efficiency tests.

5.3 High Altitude (Low Pressure)

Two TRAINS kits were subjected to a reduced atmospheric pressure environment (simulates pressure at high altitudes) to determine their ability to withstand air shipment. The test was conducted in accordance with MIL-STD-810C, Method 500.1, paragraph 3.1, Procedure I.

At the conclusion of this subtest, both test kits and their sampler-detectors were visually examined and no damage was found which could be attributed to low pressure treatment.

5.4 Accelerated Storage Tests

Thirty-two (32) TRAINS were subjected to the accelerated storage as follows:

No. of Kits	Environment	Duration
8	Intermediate Hot-Dry (+145° $\pm$ 2°F, 50% RH)	48 days
8	Tropic (+113° $\pm$ 2°F, 95-100% RH)	28 days
8	Arctic (-30°F $\pm$ 2°F)	35 days
8	Cyclic*	30 days

*Cyclic storage consisted of ten 24-hour cycles in each of the three environments (intermediate hot-dry, tropic, and arctic) for thirty cycles total.

Upon completion of the storage, the test kits were removed from the test chamber and examined. The test kits stored under simulated tropic conditions were noticeably damp due to the effect of high-humidity on the fiberboard carrying box. The high-humidity did not affect the performance of the box for transporting the sampler-detectors. No other unusual effects on the kits were noted that could be attributed to any of the storage conditions.

The individual sampler-detectors of the kits subjected to accelerated storage were removed from their protective envelopes and inspected as part of Functional Efficiency Tests (paragraphs 5.5.3 through 5.5.8). From the kits subjected to intermediate hot-dry storage, several sampler-detectors had a fine powder, presumably from the lewisite tablet, covering portions of the sampler-detectors. Except for two sampler-detectors where the lewisite tablet had completely fallen out of its holder, the normal operation of these sampler-detectors was not affected. No other unusual effects on the sampler-detectors were noted which could be attributed to the storage conditions.

5.5 Functional Efficiency Tests

TRAINS kits previously subjected to rough handling and accelerated storage tests as well as two control kits were submitted for functional efficiency tests. Only those sampler-detectors pre-engineered to give simulated positive agent detection responses were functioned, i.e., all of the sampler-detectors in each kit with the exception of the T-400 (all clear) type samplers were tested. The sampler-detectors were functioned according to the appropriate procedures as contained in the draft TRAINS Operator's Manual (TM 3-6910-307-10). The observed test spot responses were compared to the color code on the back of the sampler-

detectors and a safe/danger observation for each was made accordingly. The safe/ danger colors on the back of the sampler-detectors are described as follows:

Blister Test Spot	Blood Test Spot	Nerve Test Spot
Purple/Blue (H) or Red/Purple (CX) (colorless is safe)	Pink or Blue (colorless/tan is safe)	Colorless or Peach (blue is safe)

The safe/danger observations for each sampler-detector was recorded by noting the response given by all three test spots and, in particular, the response given by the test spot pre-engineered for a simulated positive response.

Tables 1 and 2 summarize the results from the functional efficiency tests. Table 1 shows only the proportion of pre-engineered test spots that responded as expected. Table 2 shows the proportion of sampler-detectors that responded properly when the sampler-detector is considered as a whole (including the two unaltered test spots which should exhibit a safe or negative response). The followi paragraphs, 5.5.1 through 5.5.10, provide detail observations concerning operation of the TRAINS sampler-detectors.

5.5.1 Rough Handling (Hot Conditioned)

The sampler-detectors subjected to rough handling treatment at 145°F were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Light blue spots developed on the nerve test spot of four T-401 (positive nerve) type sampler-detectors. This occurrence was not interpreted by observ conducting the test as an improper response (colorless or a peach color would normally indicate a positive test) since it was considerably different (lighter in color and covering a small area of the nerve spot) than the normal blue negative response.

c. Three T-404 (positive blood) type sampler-detectors exhibited a weak blo agent response but was recognizable as a positive blood response as expected.

d. One T-402 (positive mustard) type sampler-detector exhibited a questiona blood test response which was similar to a positive blood test. No color response would normally be expected from the blood test spot.

e. Two sampler-detectors that were found to have torn blister spots performed satisfactorily despite this slight damage.

FUNCTIONAL EFFICIENCY TEST RESULTS

TABLE 1

Pretest Conditioning	Sampler Type: Test Conditions	Proportion of Pre-Engineered Test Spots Responding Properly* T-401 (danger nerve)	T-402 (danger mustard)	T-403 (danger phosgene)	T-404 (danger blood)
Rough Handling (145°F)	Room Ambient	18/18	18/18	18/18	18/18
Rough Handling (-30°F)	-30°F	18/18	18/18	18/18	18/18
As Received (Controls)	Room Ambient	12/12	12/12	12/12	12/12
Int Hot-Dry Storage	Room Ambient	48/48	48/48	48/48	48/48
Tropic Storage	Room Ambient	48/48	48/48	48/48	48/48
Arctic Storage	-30°F	24/24	24/24	24/24	24/24
Arctic Storage	Room Ambient	24/24	23/24	24/24	24/24
Cyclic Storage	-30°F	24/24	24/24	24/24	24/24
Cyclic Storage	Room Ambient	24/24	24/24	23/24	24/24

*Pre-engineered test spot gave appropriate positive agent test.

TABLE 2

Pretest Conditioning	Sampler Type: Test Conditions	Proportion of Sampler-Detectors Responding Properly* T-401 (danger nerve)	T-402 (danger mustard)	T-403 (danger phosgene)	T-404 (danger blood)
Rough Handling (145°F)	Room Ambient	18/18	17/18	18/18	18/18
Rough Handling (-30°F)	-30°F	18/18	13/18	15/18	16/18
As Received (Controls)	Room Ambient	12/12	12/12	12/12	11/12
Int Hot-Dry Storage	Room Ambient	48/48	48/48	48/48	48/48
Tropic Storage	Room Ambient	48/48	48/48	48/48	47/48
Arctic Storage	-30°F	24/24	24/24	24/24	24/24
Arctic Storage	Room Ambient	24/24	23/24	23/24	24/24
Cyclic Storage	-30°F	24/24	24/24	22/24	24/24
Cyclic Storage	Room Ambient	23/24	23/24	22/24	24/24

*Pre-engineered test spot and two unaltered test spots gave positive agent test and negative agent tests, respectively.

5.5.2 Rough Handling (Cold Conditioned)

The sampler-detectors subjected to rough handling treatment at -30°F were functioned so as to simulate operation at arctic conditions. An environmental chamber with temperature at -30°F was utilized to simulate the outside conditions. These sampler-detectors were functioned as described in paragraph 5.5 and according to the operator's manual section describing sampler-detector operation under unusual conditions. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Light blue spots developed on the nerve test spot of one T-401 (positive nerve) type sampler-detector. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. Five T-402 (positive mustard) type, three T-403 (positive phosgene oxime) type, and two T-404 (positive blood) type sampler-detectors had nerve test spots which were difficult to wet resulting in questionable nerve test color responses (less than 50% of the test spot surface developing the blue negative response).

d. Nineteen of the 54 sampler-detectors which were expected to give a negative (blue color) response for nerve had at least a trace of peach color (indication of positive nerve) on the nerve test spot. Thirteen of these were found in one kit.

e. It should be noted that a re-inspection of the sampler-detectors referred to in c and d above revealed that the test spot became all blue sometime (in excess of 15 minutes) after the initial inspection.

5.5.3 Intermediate Hot-Dry Storage

The sampler-detectors subjected to intermediate hot-dry storage (+145°F @ 50% RH) were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Light blue spots developed on the nerve test spot of one of the T-401 (positive nerve) sampler-detector. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. Fourteen T-404 (positive blood) type sampler-detectors exhibited weak blood agent responses but were recognizable to observers as a positive blood response as expected.

d. Eight sampler-detectors had nerve test spots that were difficult to wet resulting in small portions of each spot not developing the expected blue negative nerve response.

e. Two sampler-detectors that were found to have torn blister spots performed satisfactorily despite this slight damage.

f. Six sampler-detectors (2 each type) were functioned in the dark using a flashlight as the only source of light. The pre-engineered response was correctly identified in each case.

5.5.4 Tropic Storage

The sampler-detectors subjected to tropic storage (+113°F @ 95-100% RH) were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Light blue spots developed on the nerve test spot of five T-401 (positive nerve) sampler-detectors. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. One T-404 (positive blood) type sampler-detector gave a false-positive (no color) nerve test.

d. Nine sampler-detectors that were found to have torn blister spots performed satisfactorily despite the slight damage.

e. Six sampler-detectors (2 each type) were functioned in the dark using a flashlight as the only source of light. The pre-engineered response was correctly identified in each case.

5.5.5 Arctic Storage (functioned at ambient)

Twenty-four of each type sampler-detector (except T-400, all clear) stored under arctic conditions (-30°F) were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. With the exception of one T-402 (positive mustard) type sampler-detector which did not develop a positive mustard response, all test spots pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses that developed properly developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Light blue spots developed on the nerve test spot of three T-401 (positive nerve) sampler-detectors. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. One T-403 (positive phosgene oxime) type sampler-detector gave a false-positive (no color) nerve test.

d. One T-404 (positive blood) type sampler-detector exhibited a weak blood agent response but was recognizable to observers as a positive blood response as expected.

e. Five sampler-detectors that were found to have torn blister spots performed satisfactorily despite the slight damage.

5.5.6 <u>Arctic Storage (functioned at -30°F)</u>

Twenty-four of each type sampler-detector (except T-400, all clear) stored under arctic conditions (-30°F) were functioned so as to simulate operation at arctic conditions. An environmental chamber with temperature at -30°F was utilized. These sampler-detectors were functioned as described in paragraph 5.5 and according to the operator's manual section describing sampler-detector operation under unusual conditions. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box cover.

b. Two T-404 (positive blood) type sampler-detectors had traces of peach color on the nerve test spots. Since most of the spot was blue (negative nerve), the response was interpreted as a proper negative nerve test.

5.5.7 <u>Cyclic Storage (functioned at ambient)</u>

Twenty-four of each type sampler-detector (except T-400, all clear) subjected to cyclic storage were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. With the exception of an incorrectly packaged T-403 (positive phosgene oxime) type sampler-detector (T-404 sampler-detector found in a T-403 sampler-detector bag), all test spots pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box.

b. Light blue spots developed on the nerve test spot of three T-401 (positive nerve) type sampler-detector. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. One T-402 (positive mustard) type and one T-403 (positive phosgene oxime) type sampler-detector gave false-positive (no color) nerve tests.

d. One T-401 (positive nerve) type sampler-detector had a questionable response on its blood spot. For this type of sampler-detector, a negative (no color) blood response would be expected.

5.5.8 Cyclic Storage (functioned at -30°F)

Twenty-four of each type sampler-detector (except T-400, all clear) subjected to cyclic storage were functioned so as to simulate operation at arctic conditions utilizing an environmental chamber set with temperature at -30°F. These sampler-detectors were functioned as described in paragraph 5.5 and according to the operator's manual section describing sampler-detector operation under unusual conditions. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box.

b. Light blue spots developed on the nerve test spot of one T-401 (positive nerve) sampler-detector. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. Two T-403 (positive phosgene oxime) type sampler-detectors had only traces of blue on their nerve spots and were interpreted as false-positive nerve responses.

d. Three T-404 (positive blood) type sampler-detectors exhibited weak blood agent responses but were recognizable to observers as a positive blood response as expected.

5.5.9 Controls (as received)

The sampler-detectors (12 each) that were not subjected to any special treatme conditioning were functioned as described in paragraph 5.5 at room temperature. The following observations were noted during the operation of these sampler-detectors:

a. For all sampler-detector types, the test spot pre-engineered to give a positive agent response gave the expected color response. All pre-engineered responses developed within the three minute time requirement as stated in the operational instructions inside the carrying box.

b. Light blue spots developed on the nerve test spot of one T-401 (positive nerve) sampler-detector. This occurrence was similar to that described in paragraph 5.5.1.b and treated as such.

c. One T-404 (positive blood) type sampler-detector gave a false-positive (no color) nerve response.

d. One sampler-detector that was found to have a torn blister spot performed satisfactorily despite this slight damage.

5.5.10 General Observations

The following general observations were made during the operation of the TRAINS sampler-detectors:

a. All sampler-detectors functioned during this test program had the ink from the printed test colors on the back of sampler-detectors run during operation. This occurrence was believed to be the cause of the light blue spots which developed on the nerve spot of many of the T-401 sampler detectors.

b. On a total of six occasions, ampoule glass pierced the plastic cover when the ampoule was broken during operation.

6. RELIABILITY

Product Assurance Directorate reviewed EDT data and prepared a reliability assessment which is included as Appendix B of this report. A summary of findings is included in this section.

A worst case analysis (reference Table 2, page 6) was provided and concluded that:

a. Samplers T-401, T-402, and T-404 yielded a 90% reliability at confidence levels greater than or equal to 90% for all storage conditions.

b. Sampler T-403 yielded a 90% reliability at confidence levels greater than or equal to 90% for all storage conditions except cyclic; for the cyclic condition, a 90% reliabilty at 50% confidence level was satisfactorily demonstrated.

An alternate analysis (reference Table 1, page 6) was also provided which showed that with the exception of two failures, all test results met the requirement with 90% reliability at a 92.5% confidence level.

7. SAFETY

The Chemical Systems Laboratory Safety Office reviewed the test data and issued the following statement for inclusion in this final report:

"The numbers and types of failures that occurred during the test program indicate that the kit is safe to use as intended. Incorrect responses, within reliability limits do not pose a hazard to personnel since during the course of a training program each soldier should function sufficient samplers to become cognizant of the correct responses. In addition, the low incidence of the ampoule glass piercing the plastic cover when the ampoule is broken is yet another indication that the kit is safely designed. Results of the high altitude test indicate that the kit should be safely transportable by air."

8. DISCUSSION

The following discussion concerning the TRAINS kit is based on the results from the conduct of Engineer Design Test No. 209 and information from other sources when indicated.

8.1 Results of rough handling testing indicate that the fiberboard box and its contents are capable of withstanding shock and vibration that may be encountered as a consequence of transportation and use in field training exercises.

8.2 High Altitude (Low Pressure) testing results indicate that the TRAINS can withstand reduced air pressure encountered during shipment by air and storage at high ground elevations.

8.3 Functional efficiency testing indicates that the pre-engineered response can be expected to develop as intended under the types of storage and operational conditions found in this test program.

8.4 It was noted that in all cases of sampler-detector operation, the solvent used in blood agent test spot area dissolved the blue dye in the ink used as an example of a positive blood agent test which then leaches across the paper laminated in the plastic (see Appendix D). Two problem areas potentially could result from this occurrence:

a. The printed sample responses (particularly the blood sample color) may become washed out making a color comparison difficult.

b. The dissolved dye may travel onto the nerve spot (as was shown in this test program to occur occasionally) and cause light blue spots to develop on the test spot in the case of a simulated positive (no color) nerve response. Since a blue nerve spot is an indication that no nerve agent is present, the blue spots may cause uncertainty of the user in regards to the correct interpretation of this response.

8.5 A number of nerve agent test spots (particularly those from rough handling and functioned at -30°F) provided responses that were interpreted as false-positive. This problem appears to be due to difficulty in wetting the enzyme impregnated in the nerve spot.

8.6 The problems with some levisite test tablets that softened and became powdery after hot-dry storage are probably caused by improper manufacture (see Appendix D).

8.7 Since the TRAINS sampler-detectors used in this test program were manufactured so as to be identical, with the exception of the pre-engineered test spots, to the standard M256 sampler-detector, it is assumed that the problems as discussed in 8.4, 8.5, and 8.6 are potentially common to the actual M256 sampler-detector.

8.8 CB Detection and Alarms Division has proposed corrective action for the problem areas discussed in 8.4, 8.5 and 8.6. The proposed actions are included in Appendix D of this report.

9. CONCLUSIONS

The Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) generally met the principal characteristics of the TDLR (approved 23 Nov 79) that were appropriate to the pre-engineered device. These are discussed in detail in Appendix A. However, the following problem areas should be noted:

a. Ink from the blood test sample color bleeds across the back of the sampler-detector and in some cases travels onto the nerve test spot.

b. The nerve spot of T-402 (positive mustard), T-403 (positive phosgene oxime), and T-404 (positive blood) type sampler-detectors were sometimes difficult to wet, which could result in a false-positive response interpretation.

c. Lewisite test tablets soften and become powdery after hot-dry storage.

10. RECOMMENDATIONS

On the basis of the results of this test, it is recommended that:

a. The TRAINS sampler-detector should be modified so that contact between the solvent and the printed instructions on the back of the sampler-detector be prevented.

b. The ability to wet the nerve spot should be improved.

c. Lewisite tablets should be improved so as not to become softened by hot-dry storage.

d. Since the problem areas of the TRAINS sampler-detector may also be representative of the actual M256 sampler-detector, the above recommendations should also be considered for improvement of the standard M256 sampler-detector.

e. Upon accommodation of the above recommendations (as indicated by the developer's proposed actions, Appendix D), the Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) should be considered for adoption for use as a training device for the M256 Chemical Agent Detector.

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DRDAR-QAC-R Training Device for Detection Kit, Chemical Agent, M256

Cdr/Dir, CSL Dir, Prod Assurance 22 JAN 1982

ATTN: DRDAR-CLC-CK Mr. Chan/map/2223

Attached is Reliability Assessment of the subject item for your use and retention.

FOR THE DIRECTOR:

1 Incl
as

RAYMOND G. CRAFTON
Chief, Chemical Systems Division

CF:
Cdr/Dir, CSL (DRDAR-CLJ-M/Mr. A. Subrizi) w incl
Dir, Prod Assurance (DRDAR-QAC-P/Mr. J. Trost) w incl

APPENDIX C

SYSTEMS SHELF LIFE AND STORAGE MANAGEMENT TEST
REPORT FOR SIMULATOR, DETECTOR TICKETS,
CHEMICAL AGENT: TRAINING M256

Blank

RELIABILITY ASSESSMENT

FOR

SIMULATOR, DETECTOR TICKETS, CHEMICAL

AGENTS: TRAINING, M256 (TRAINS)

MARCH 1983*

PRODUCT ASSURANCE DIRECTORATE

CHEMICAL SYSTEMS DIVISION

CB DETECTION & ALARMS BRANCH

ABERDEEN PROVING GROUND, MD 21010

* Supersedes Reliability Assessment, January 1982

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PART A

SUMMARY

1. PURPOSE: The purpose of this Assessment is to provide an independent quantitative analysis of test data accumulated on kits during the Engineering Design Test (EDT) and Operational Test II (OT II) and to recommend if the M256 TRAINS is suitable for adopting into the Army inventory.

2. SCOPE:

This assessment analyzes test data of Reference 1, Results of Engineer Design Test No. 209 (EDT 209). The data comprises sampler sensitivity testing of forty two (42) complete kits; thirty two (32) after exposure to cyclic temperature storage, six (6) after rough handling, two (2) after high altitude and two (2) as received. Additionally, a system shelf life test was conducted as a separate program and Reference 2 is the System Shelf Life and Storage Management Test Report. Because of instances of creep of the solution from the desired spot into an adjacent spot(s), an analysis (worst case) is provided. An alternate analysis which evaluates the inherent capability of the individual spots performance, discounting interactions among the various spots, is also provided.

Reference 3 and Reference 4 provided the results and evaluation of the operational effectiveness and military utility of the M256 TRAINS. An analysis is also included in this assessment of the above references.

3. CONCLUSIONS:

3.1 Engineering Design Test (EDT)

3.1.1 Samplers T-401, T-402 and T-404 yielded a 90% reliability at confidence levels greater than or equal to 90% for all storage conditions.

3.1.2 Sampler T-403 yielded a 90% reliability at confidence levels greater than or equal to 90% for all storage conditions except cyclic; for the cyclic condition, a 90% reliability at 50% confidence level was satisfactorily demonstrated.

3.1.3 The System Shelf Life Study predicted a minimum shelf life in excess of five (5) years for storage at ambient temperature (nominally 70°F).

3.1.4 Minimal damage resulted from rough handling tests; small sample sizes negated reliability calculations.

3.1.5 No damage to kits results from the high altitude (low pressure) tests.

3.1.6 Some interference among the spots does occur, as it does in the M256 Detector Kit.

3.2 Operational Test II (OT II)

PART B

BACKGROUND

1. DESCRIPTION OF THE ITEM: The Simulator, Detector Tickets, Chemical Agents: Training, M256 (TRAINS) is shown in Figure 1. The instructions and components in the TRAINS are detailed in Table 1.

2. REQUIREMENTS:

The Simulator, Detector Tickets, Chemical Agents: Training, M256 (TRAINS) was tested against criteria established by the Training Device Letter Requirements (TDLR), which was revised and updated July 1982, as follows:

a. Shall have a shelf life at least as long as the M256 Chemical Agent Detection Kit (5 years).

b. Shall have a probability of at least .90 that it will give a positive test when functioned.

c. It is a "one-shot" non-maintainable item, therefore, durability, maintainability and availability are not included.

3. PERFORMANCE CRITERIA: Since the item is pre-engineered to give a proper color response simulating agent responses, the success-failure criteria is on a "go-no-go" basis. A positive test (color change) shall be a success; a negative test (no color change) shall be a failure. The simulated positive nerve agent test is obtained by omitting the enzyme, therefore, a color change is not possible.

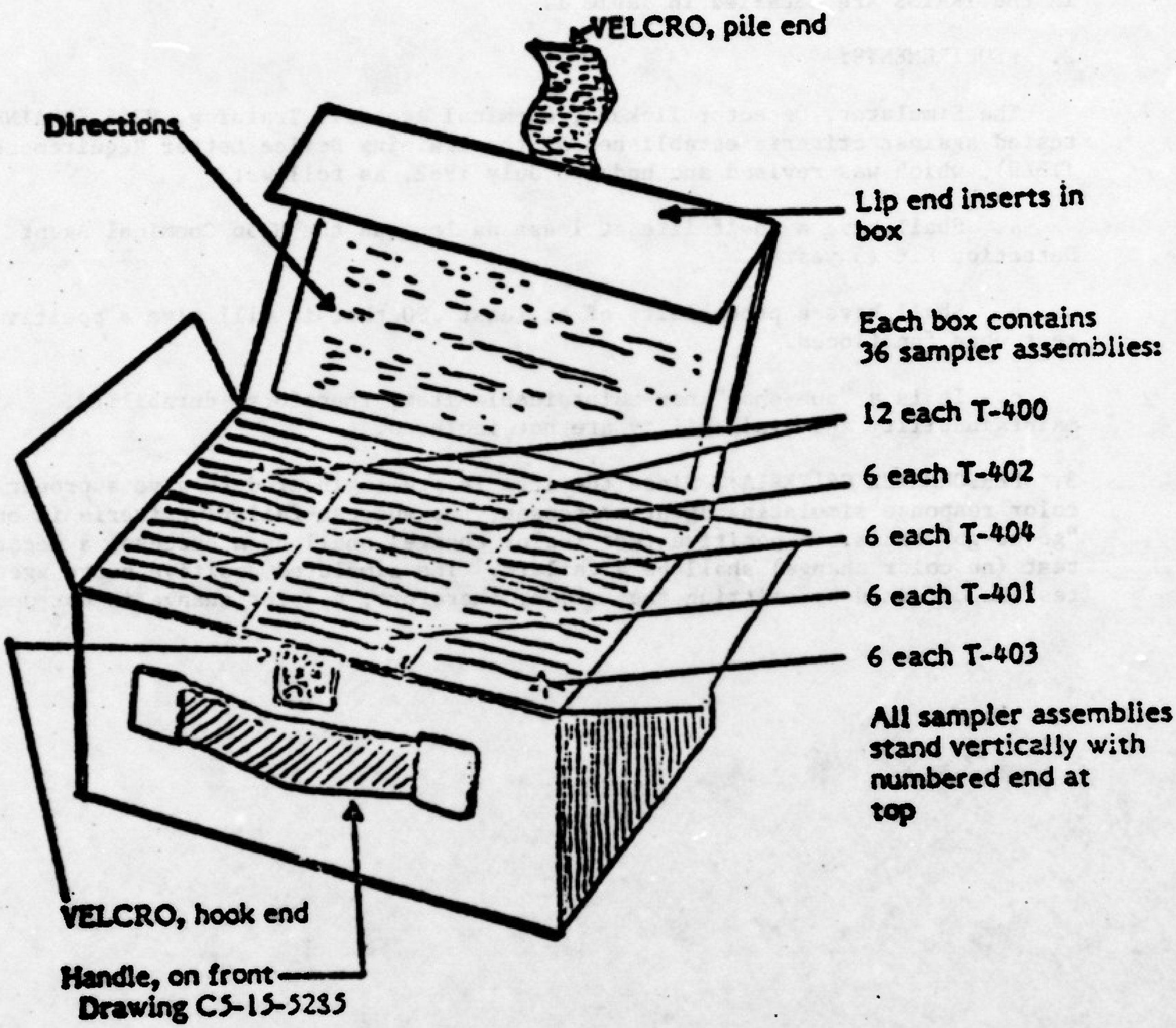

FIGURE 1 - SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENT: TRAINING, M256 (TRAINS) WITH COMPONENT PARTS LOCATED AND IDENTIFIED

3.2.1 One hundred percent (100%) of the blister and nerve agent tests matched the response color. Ninety percent (90%) of the blood spots matched the color provided with the samplers.

3.2.2 The container boxes held up exceptionally well during the test period and protected the samplers from damage attributed to storage, transportation, operational use, and exposure to water.

3.2.3 Sampler packages provided adequate protection for its contents.

3.2.4 Minor degradation of the sampler package and lettering occured during the test.

3.2.5 The reliability equals 91.2% at 92.5% confidence level of successful operation of the M256 TRAINS during the training exercises.

4. RECOMMENDATION: M256 TRAINS be adopted into the Army inventory.

5. DISCUSSIONS:

5.1 During the Operational Test II (OT II), the disposal of the M256 TRAINS required special disposal procedures and techniques which differ from the disposal of the standard M256 kit and thus required additional logistical support. This created a logistics burden and degraded its value as a training device. (See References 3 and 4.)

5.2 Consideration should be given to replacement of all chemicals which cause a hazardous waste disposal problem in the M256 TRAINS and an expanded first article test and a Follow-On-Evaluation (FOE), by the US Army Chemical School be used to confirm that changes have not degraded the effectiveness of the M256 TRAINS. CB Detection and Alarms Branch, Product Assurance Directorate, ARRADCOM, will provide an independent analysis of the expanded first article test.

OPERATIONAL INSTRUCTIONS
TRAINING SET

Contents: Carrying box with handle
Training Samplers: 36 each in protective bag

GENERAL: Read these instructions before proceeding.

A. These instructions are limited to instructor/trainer use only; NOT for student/trainee use. Use of this set assumes student/trainee is knowledgeable in use of M256 kit.

B. Sampler instructions are shown on side 1 and side 2 of protective bag. Observational instructions showing safe and danger colors are on enclosed sampler.

CAUTION: 1. These samplers are for TRAINING ONLY: DO NOT USE FOR CHEMICAL AGENTS.
CAUTION: 2. Protective mask and gloves must be worn when using samplers.
CAUTION: 3. If sampler is damaged or becomes wet, do not use.

C. 1. Samplers simulate safe and danger color changes obtained with Detector Kit, Chemical Agent, M256.
2. Samplers will simulate tests for the following agents:
NERVE - (G) and (V).
BLISTER - (H) Mustard; (CX) Phosgene Oxime.
BLOOD - (AC) Hydrogen Cyanide; (CK) Cyanogen Chloride.
3. Sampler/bag markings correspond to the following simulated color tests:

MARKING	SIMULATED TEST FOR
T-400	SAFE, "ALL CLEAR" - Negative NERVE, BLISTER, BLOOD.
T-401	DANGER - Positive NERVE (G) or (V).
T-402	DANGER - Positive BLISTER (H) Mustard.
T-403	DANGER - Positive BLISTER (CX) Phosgene Oxime.
T-404	DANGER - Positive BLOOD (AC) Hydrogen Cyanide or (CK) Cyanogen Chloride.

D. 1. Instructor decides agent/alert to be simulated.
2. Only one agent condition should be simulated at one time; agent types should not be mixed.

E. Entire sampler must be read within 3 minutes, then discard sampler.

Instructions for Training Set

TABLE 1

TRAINS INSTRUCTIONS AND COMPONENTS

PART C

TEST AND EVALUATION

I. ENGINEERING DESIGN TEST (EDT)

1. STORAGE

The test plan per reference 3 was designed to establish a 90% reliability at 92.5% confidence level. Thirty two (32) test kits containing their normal full complement of samplers were stored under environmental conditions and duration as follows:

NO. OF KITS	ENVIRONMENTS	DURATION (DAYS)
8	Intermediate hot-dry (145°F±2°F, 50% RH)	48
8	Tropic (113°F±2°F, 95-100% RH)	28
8	Arctic (-30°F±2°F)	35
8	Cyclic	30

Reliability calculations were made using binomial probability theory and assuming the probability of failure is equal in all samplers and at each environmental condition. The reliabilities at the 92.5% confidence level were approximately 90% for each sampler as shown in Table 2. The confidence level associated with 90% reliability was greater than 92.5% for all sampler tests*.

*Exceptions are T-401 at cyclic storage (ambient), T-402 at arctic and cyclic storage (ambient), T-403 at arctic storage (ambient) and cyclic (ambient and cold).

TABLE 2 - RELIABILITY CALCUATIONS FOR STORAGE

SAMPLER TYPE	STORAGE CONDITIONS		TEST RESULTS (NO. OF SUCCESS/ NO. OF TEST)	RELIABILITY AT 92.5% CONFIDENCE LEVEL	CONFIDENCE LE FOR 90% RELIABILITY
T-401	Intermediate Hot/Dry		48/48	94.7	99.25
	Tropic		48/48	94.7	99.25
	Arctic	(Ambient)	24/24	90.0	92.50
		(Cold)	24/24	90.0	92.50
	Cyclic	(Ambient)	23/24	83.3	90.00
		(Cold)	24/24	90.0	92.50
T-402	Intermediate Hot/Dry		48/48	94.7	99.25
	Tropic		48/48	94.7	99.25
	Arctic	(Ambient)	23/24	83.3	90.00
		(Cold)	24/24	90.0	92.50
	Cyclic	(Ambient)	23/24	83.3	90.00
		(Cold)	24/24	90.0	92.50
T-403	Intermediate Hot/Dry		48/48	94.7	99.25
	Tropic		48/48	94.7	99.25
	Arctic	(Ambient)	23/24	83.3	90.00
		(Cold)	24/24	90.0	92.50
	Cyclic	(Ambient)	22/24	77.8	50.00
		(Cold)	22/24	77.8	50.00
T-404	Intermediate Hot/Dry		48/48	94.7	99.25
	Tropic		47/48	91.3	95.00
	Arctic	(Ambient)	24/24	90.0	92.50
		(Cold)	24/24	90.0	92.50
	Cyclic	(Ambient)	24/24	90.0	92.50
		(Cold)	24/24	90.0	92.50

2. SYSTEM SHELF LIFE TESTS

System shelf life tests were conducted as a separate study and the results were reported in reference 2, System Shelf Life and Storage Management Test Report. It was concluded from the shelf life study that a shelf life of at least five (5) years is projected for the kit stored at ambient temperature.

3. ROUGH HANDLING

Six unpacked TRAINS kits (test kits) containing their normal complement, i.e., each kit containing 36 samplers, were tested at -30°F (cold conditioned) and 145°F (hot conditioned).

3.1 Hot Conditioned Kits

- Five foot drop - Drops resulted in insignificant damage to the box.
- Vibration - Secured Cargo - No damage was noted to any of the three kits following this test.
- Vibration - Loose Cargo - No damage was noted to any of the three kits following this test.
- Sampler Inspection - Two samplers had torn blister spots. No other damage was noted.
- Functional efficiency tests - Only one failure was found in sampler T-402. Since only 18 tests for each sampler type were run, reliabilities were not determined.

3.2 Cold Conditioned Kits

- Five foot drop - Drops resulted in insignificant damage to the box.
- Vibration - Secured Cargo - No damage was noted to any of the three kits following this test.
- Vibration - Loose Cargo - No damage was noted to any of the three kits following this test.
- Sampler Inspection - One T-403 sampler had an empty ampoule. No other damage was noted.
- Functional efficiency tests - 5 failures in T-402 samplers, 3 failures in T-403 samplers and 2 failures in T-404 samplers. Since only 18 tests for each sampler type were run, reliabilities were not determined.

4. CONTROL (AS RECEIVED)

Only one failure was found in the T-404 samplers. Since only 12 tests for each sampler type were run, reliabilities were not determined.

5. HIGH ALTITUDE (LOW PRESSURE)

No damage to kit or contents was noted.

6. ALTERNATIVE ANALYSIS

Evaluating the inherent capability of the various spots to function, independent of any interactions (creep) with the remaining spots, the tests results provided by reference 1 would be as shown in Table 3. With this interpretation of what comprises a TRAINS "failure"; only two "failures" occurred.

However, since interactions of the various spots do occur on both the M256 TRAINS and the M256 Detector Kit and is more realistic and representative of what the "GI" will experience in a training situation, minimization of this situation should be noted and addressed.

TABLE 3 - ALTERNATE ANALYSIS OF TEST DATA

TEST CONDITIONS / SAMPLERS	T-401 SUCCESSES / NO. TESTED	T-402 SUCCESSES / NO. TESTED	T-403 SUCCESSES / NO. TESTED	T-404 SUCCESSES / NO. TESTED
Rough Handling				
Hot	18/18	18/18	18/18	18/18
Cold	18/18	18/18	18/18	18/18
Controls (As Received)	12/12	12/12	12/12	12/12
Storage*				
Intermediate Hot/Dry	48/48	48/48	48/48	48/48
Tropic	48/48	48/48	48/48	48/48
Arctic (AMB.)	24/24	23/24	24/24	24/24
Arctic (COLD)	24/24	24/24	24/24	24/24
Cyclic (AMB.)	24/24	24/24	23/24	24/24
Cyclic (COLD)	24/24	24/24	24/24	24/24

*Except for those two failures, all test results met the requirement with 90% reliability @ 92.5% confidence level.

II. OPERATIONAL TEST II (OT II)

1. PACKAGING:

Although each of the M256 TRAINS container suffered some separation of the cardboard layers, all of the ten (10) boxes soaked prior to the test held up. The container boxes provided excellent protection for the samplers during storage, transportation and operation use. The point estimate of the physical reliability is 100%.

Minor degradation of the sampler package and lettering occurred primarily from being carried in the actual M256 carrying case. Portions of lettering was rubbed off on 13 samplers. However, this has no affect on the operation.

2. COLOR RESPONSE:

The response colors for blister and nerve agent tests matched 100% with the color code provided with the samplers. Only 90% of the positive blood test samplers matched the color code. At 90% confidence level, reliability of the blood test is 87%. This is considered adequate; a 100% reliability is unrealistic.

The M256 TRAINS blood sampler displayed the color pink indicating a "weak" presence of agent. It is a design carry-over from the M256 kit to the M256 TRAINS. Therefore, it should not be considered as a deficiency to the M256 TRAINS.

3. FUNCTIONAL TEST:

Nine hundred ninety-seven (997) M256 TRAINS samplers were functioned. Eleven of the samplers were considered to have had relevant failures as shown in Table 4. The probability of success was demonstrated with a 92.5 % confidence that the true population probability is above 98.3%.

One hundred forty-one (141) of the total 168 T404 samplers used during the test displayed pink indicating a "weak" presence of agent. If those displaying pink are considered as failures, the reliability is 83.2% at 92.5% confidence level.

Since there is a discrepancy as to the true failure and no scoring conference was held, a true reliability cannot be calculated for OT II test data. However, based on the table below, using an estimated 75 failures provides a reliability of 91.2% at 92.5% confidence level.

Number of Failures	$\bar{R}$ @ 92.5% C.L.
10	.985
25	.967
50	.939
75	.912
100	.885
125	.857
150	.832

TABLE 4 - RAM DATA - OT II TEST RESULTS

Sampler Code	Number of Failures	Defect Remarks
T-400	1	Missing blister spot.
T-401	2	One false negative and one misplaced heater rivet.
T-402	0	--
T-404	8	Seven false negative and one heater split.
Total	11	

PART D

REFERENCES

1. Results of Engineer Design Test No. 209 (EDT 209) for Simulator, Detector Tickets, Chemical Agents: Training, M256 (TRAINS), Chemical Systems Laboratory, 29 December 1981.

2. System Shelf Life and Storage Management Test Report of Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS), RAM Engineering Branch, Chemical Systems Division, Product Assurance Directorate, November 1981.

3. Operational Test II of Training Device for the Detection Kit, Chemical Agent, M256, US Army Armor and Engineer Board, Ft. Knox, KY, 40121, 9 November 1982.

4. Independent Evaluation Report (IER), Training Device for the Detector Kit, Chemical Agent, M256, US Army Chemical School, Ft. McClellan, AL, 36205, December 1982 (Draft).

APPENDIX D

INDEPENDENT EVALUATION REPORT FOR DT OF THE TRAINING SIMULATOR SET (TRAINS) FOR THE M256 CHEMICAL AGENT DETECTOR KIT

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INDEPENDENT EVALUATION REPORT
FOR DT II OF THE
TRAINING SIMULATOR SET (TRAINS)
FOR THE
M256 CHEMICAL AGENT DETECTOR KIT

BY

MAJ GEORGE L. FRANKLIN

JULY 1982

HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Detection Responses
Sampler/Detectors
Lewisite Tablet
Chemical Agents
Training Simulator Set (TRAINS)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This TECOM evaluation describes the results of the DT II testing of the TRAINS for the M256 kit which was conducted from October through November 1981. Testing took place at the Chemical Systems Laboratory, Aberdeen Proving Ground, Maryland and was monitored by Dugway Proving Ground, Utah. The test objective was to determine whether or not the TRAINS had met the requirements of the TDLR and should be accepted in the Army inventory as a stock funded item.

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INDEPENDENT EVALUATION REPORT
FOR DT II OF THE
TRAINING SIMULATOR SET (TRAINS)
FOR THE M256 CHEMICAL AGENT DETECTOR KIT

SECTION I: BACKGROUND INFORMATION

A. HISTORY.

1. Chemical Systems Laboratory (CSL) has developed a training device which provides a method for realistically simulating the use and detection responses of the M256 Chemical Agent Detector. The device, nicknamed TRAINS (for Training Simulator Set) (Figure 1), is programmed to give simulated detection responses in the absence of both chemical agents and chemical agent simulants, which makes the item especially suitable for field training exercises.

2. Development of the TRAINS was accomplished by an accelerated development program in which TRAINS proceeded into the Full Scale Engineering Development Phase immediately following the Exploration of Alternative Systems Concept Phase. To further expedite the program, a CSL Engineer Design Test (EDT) program to fulfill the requirements for DT II of the TRAINS was agreed to in principle at the initial meeting of the informal TRAINS TIWG held 28 November 1980. An EDT Plan was developed by CSL and submitted to TECOM for review. TECOM confirmed that the EDT Plan was adequate for use as the Independent Evaluation Plan/Test Design Plan (IEP/TDP) for TRAINS DT II. It was from this plan that the tests were conducted and this report was prepared.

B. SCOPE. The Training Device Letter Requirement (TDLR) was approved in November 1980. DT II was conducted by CSL on 42 kits in 1981 in accordance with a plan coordinated with TECOM in July 1981. Testing was monitored by US Army Dugway Proving Ground (DPG). The results of testing are reported in the final report from DPG, reference 1.

C. SYSTEM DESCRIPTION. The Training Simulator Set (TRAINS) was developed to provide training in use of the M256 Chemical Agent Detector Kit during full-scale chemical training operations. It contains an assortment of 36 samplers to simulate positive nerve, blister (i.e., mustard, phosgene oxime), and blood (i.e., AC and CK) agent responses and negative "all-clear" responses. The Training Simulator Set used M256 kit sampler/detectors that were programmed to give positive simulated agent responses when activated without the presence of actual agent or simulants. Samplers are identical in physical appearance and characteristics to M256 sampler/detectors, except that they are coded both numerically and with a blue coloration to designate them as a training item. Chemically, they no longer detect agent. The set consists of 36 samplers, of which 12 are authentic M256 sampler/detectors for simulated negative response, and 24 are programmed for simulated positive responses (six each of nerve, mustard, phosgene oxime, and blood). They are packaged in blue, sealed, plastic/laminated bags and packed in a blue, water-resistant fiberboard box approximately 11-3/4" X 7-1/2" X 5-3/8". Simple instructions are fastened to the inside of the box lid.

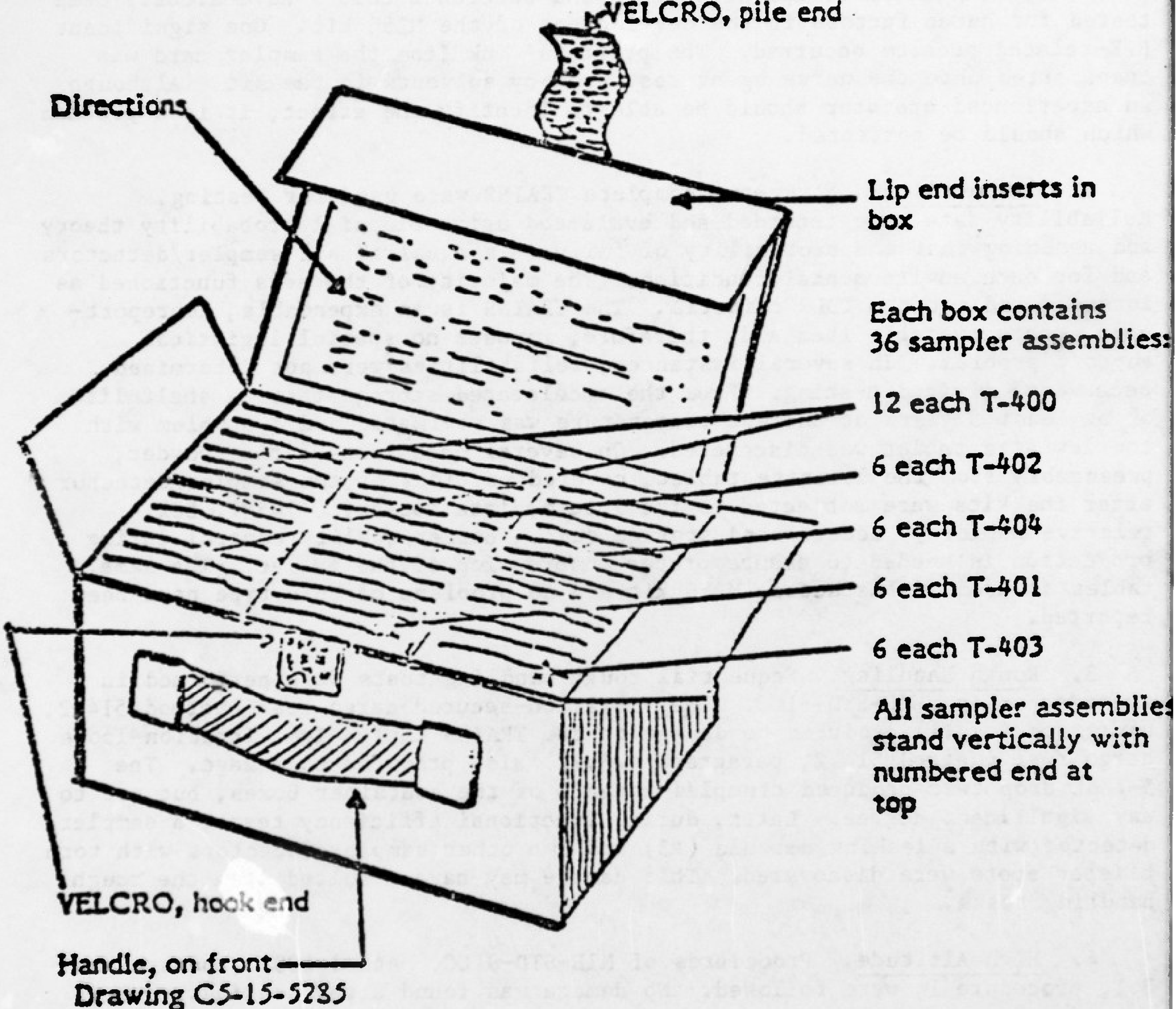

FIGURE 1 - SIMULATOR, DETECTOR TICKETS, CHEMICAL AGENT: TRAINING, M256 (TRAINS) WITH COMPONENT PARTS LOCATED AND IDENTIFIED

SECTION II: EVALUATION

A. RESULTS OF EVALUATION.

1. Human Factors Engineering (HFE). A formal HFE evaluation was not conducted because the kit is identical in design to the M256 sampler/detector, and the colors produced by the simulator test spots are consistent in color intensity with those of the M256 kit. The reference colors have already been tested for human factors in the development of the M256 kit. One significant HFE-related problem occurred. The printers' ink from the sampler card was transported onto the nerve agent test spot by solvents in the kit. Although an experienced operator should be able to identify the effect, it is a problem which should be corrected.

2. Reliability. Forty-two complete TRAINS were used for testing. Reliability data were recorded and evaluated using binomial probability theory and assuming that the probability of failure is equal in all sampler/detectors and for each environmental condition. The majority of the sets functioned as intended and met the TDLR criteria. The TRAINS is an expendable, nonreportable, nonrecoverable item and, therefore, imposes no special logistical support problem. In several instances, reliabilities were not determined because of limited testing. From the accelerated storage test, a shelf life of at least 5 years at ambient temperature was estimated and a problem with the lewisite tablet was discovered. On several occasions, a fine powder, presumably from the lewisite tablet, covered portions of the sampler/detector after the kits were subjected to the intermediate hot-dry (+145°F, 50% relative humidity) accelerated storage test. Better quality control during production is needed to ensure proper compression of the tablet. The same tablet is used in the actual M256 kit and no problems of this type have been reported.

3. Rough Handling. Sequential rough handling tests were performed in accordance with MIL-STD-810C. The vibration-secured cargo test (Method 514.2, paragraph 4.6.11) produced no damage to the TRAINS kits. The vibration-loose cargo test (Method 514.2, paragraph 4.6.12) also produced no damage. The 5-foot drop test produced crumpled corners of the container boxes, but not to any significant degree. Later, during functional efficiency tests, a sampler/detector with a leaking ampoule (#5) and two other sampler/detectors with torn blister spots were discovered. This damage may have resulted from the rough handling tests.

4. High Altitude. Procedures of MIL-STD-810C, Method 500.1, paragraph 3.1, procedure I, were followed. No damage was found after testing.

5. Functional Efficiency Tests. Tables I and II summarize the results from the functional efficiency tests. Table I shows only the proportion of programmed test spots that responded as expected. Table II shows the proportion of sampler/detectors that responded properly when the sampler/detector is considered as a whole (including the two unaltered test spots which should exhibit a safe or negative response). The details of each subtest are found in reference 2, paragraph 3.3. One negative result was that the ink ran

FUNCTIONAL EFFICIENCY TEST RESULTS

TABLE I

PROPORTION OF PRE-ENGINEERED TEST SPOTS RESPONDING PROPERLY*

		Sampler Type			
Pretest Conditioning	Test Conditions	T-401 (danger nerve)	T-402 (danger mustard)	T-403 (danger phosgene)	T-404 (danger blood)
Rough Handling (145°F)	Room Ambient	18/18	18/18	18/18	18/18
Rough Handling (-30°F)	-30°F	18/18	18/18	18/18	18/18
As Received (Controls)	Room Ambient	12/12	12/12	12/12	12/12
Int Hot-Dry Storage	Room Ambient	48/48	48/48	48/48	48/48
Tropic Storage	Room Ambient	48/48	48/48	48/48	48/48
Arctic Storage	-30°F	24/24	24/24	24/24	24/24
Arctic Storage	Room Ambient	24/24	23/24	24/24	24/24
Cyclic Storage	-30°F	24/24	24/24	24/24	24/24
Cyclic Storage	Room Ambient	24/24	24/24	23/24	24/24

* Pre-engineered test spot gave appropriate positive agent test.

FUNCTIONAL EFFICIENCY TEST RESULTS

TABLE II

PROPORTION OF SAMPLER/DETECTORS RESPONDING PROPERLY*

Pretest Conditioning	Test Conditions	Sampler Type T-401 (danger nerve)	T-402 (danger mustard)	T-403 (danger phosgene)	T-404 (danger blood)
Rough Handling (145°F)	Room Ambient	18/18	17/18	18/18	18/18
Rough Handling (-30°F)	-30°F	18/18	13/18	15/18	16/18
As Received (Controls)	Room Ambient	12/12	12/12	12/12	11/12
Int Hot-Dry Storage	Room Ambient	48/48	48/48	48/48	48/48
Tropic Storage	Room Ambient	48/48	48/48	48/48	47/48
Arctic Storage	-30°F	24/24	24/24	24/24	24/24
Arctic Storage	Room Ambient	24/24	23/24	23/24	24/24
Cyclic Storage	-30°F	24/24	24/24	22/24	24/24
Cyclic Storage	Room Ambient	23/24	23/24	22/24	24/24

* Pre-engineered test spot and two unaltered test spots gave positive agent test and negative agent tests, respectively.

from the printed test colors on the back of the sampler/detectors during functional testing. This occurrence is believed to have caused light blue spots to develop on the nerve spot of many of the T-401 sampler/detectors. Also, on six occasions, ampoule glass pierced the plastic cover when the ampoule was broken during operation. Because of the low incidence of ampoule breakage, TECOM does not consider this to be a problem. Overall results of the functional efficiency tests indicate minimal effects from the various handling and storage conditions.

6. Safety.

a. The CSL Safety Office reviewed the test data and issued the following statement for inclusion in this final report:

> "The numbers and types of failures that occurred during the test program indicate that the kit is safe to use as intended. Incorrect reponses, within reliability limits, do not pose a hazard to personnel since during the course of a training program, each soldier should function sufficient samplers to become cognizant of the correct responses. In addition, the low incidence of the ampoule glass piercing the plastic cover when the ampoule is broken is yet another indication that the kit is safely designed. Results of the high altitude test indicate that the kit should be safely transportable by air."

b. Testing of the chemicals found in the TRAINS has already been conducted by the Army Environmental Hygiene Activity (AEHA); no significant hazard exists. TECOM concurs with the CSL Safety Office conclusion.

B. CONCLUSION. The TRAINS is considered ready for full-scale production.

C. RECOMMENDATIONS.

a. The TRAINS be accepted in the Army inventory as a stock funded item and entered into the production phase of development.

b. The instruction sheet on the sampler card be sealed in plastic and notches be extended to prevent solvents in the sampler from dissolving the printers' ink.

c. Quality control be tightened to ensure that lewisite tablets are of proper hardness and that samplers are properly marked.

SECTION III: APPENDIX

REFERENCES

1. Final Report, US Army Dugway Proving Ground, STEDP-MT-DA-T, subject: Final Report, Development Test II (PQT-G) of Training Simulator Set (TRAINS) for M256 Chemical Agent Detector Kit, TECOM Project No. 8-ES-395-256-003, dated 24 March 1982.

2. Report of Test, Engineer Design Test (DT II) for the Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS) (EDT No. Z09), Chemical Systems Laboratory, APG, MD 21010, DRDAR-CLJ-M, dated 26 January 1982.

APPENDIX E

RELIABILITY, AVAILABILITY, AND MAINTAINABILIITY (RAM)
TEST (DT II) FOR SIMULATOR, DETECTOR TICKETS,
CHEMICAL AGENT: TRAINING, M256

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APPENDIX E

Characteristics of Simulator, Detector Tickets, Chemical Agent: Training, M256 (TRAINS)

TDLR Para	Principal Characteristics of TRAINS from the TDLR (approved 28 Nov 80)	Remarks
5a	Shall be identical in physical appearance and characteristics to the M256 Chemical Agent Detection Kit, except that its packaging, as well as the detector itself, shall be blue or marked with blue to identify it as a training item.	The TRAINS test items were manufactured so that the sampler-detectors were identical in physical appearance and characteristics to the actual M256 sampler-detector except that its packaging was colored blue with yellow printing, and the sampler-detector itself was marked with blue to identify it as a training item. The TRAINS sampler-detectors were submitted for test in blue, fiberboard boxes each of which contained 30 sampler-detectors.
5b	Shall be capable of detecting and responding to achievable field concentrations of OTSG-approved training simulants. The training and augmenting simulants shall provide a realistic range of responses consistent with the detection capabilities of the M256 kit.	This characteristic is not applicable to the pre-engineered training device. However, the TRAINS sampler-detectors does provide a means for simulating the detection of mustard, nerve agents, phosgene oxime, and blood agents.
5c	Shall be capable of operation and storage in the basic climatic design type as delineated by AR 70-38. The training device for the M256 kit will preferably exhibit the same inherent problems that accompany cold weather operations as the M256 kit; i.e., the difficulty of getting two reactions to occur at low ambient air temperatures.	The pre-engineered positive responses generally responded as intended after storage and in the operational conditions simulated during this test program.
5d	Shall be capable of engineering modification that will adapt it for use with developmental simulant agents that become OTSG-approved. Any developmental simulant agent for potential OTSG approval is required to have a chemical reaction that will enable it to be detected. This requirement is part of the Phase III Training Systems Program.	This characteristic is not applicable to the pre-engineered training device.

TDLR Para	Principal Characteristics of TRAINS from the TDLR (approved 28 Nov 80)	Remarks
5e	Shall have a shelf life at least as long as the M256 Chemical Agent Detection Kit (5 years).	Results of a System Shelf Life and Storage Management Test (Appendix C) indicates that the TRAINS sampler-detectors should meet the five year shelf life requirement.
5f	Shall have a probability greater than or equal to .90 that it will detect approved chemical agent simulants with vapor pressures that produce detectable vapor concentrations at least 15 meters downwind from the line of dissemination for at least 10 minutes after disseminated in wind speeds between 3 and 15 knots and temperatures between 20 and 100 degrees F.	This characteristic is not applicable to the pre-engineered device. However, it should be noted that with the exception of two failures, the pre-engineered spots met the requirement with .90 reliability at a 92.5% confidence level. When the overall sampler-detector is considered (including the two unaltered test spots), T-401, T-402, and T-404 type sampler-detectors yielded a 90% reliability at confidence levels greater than or equal to 90% for all of the storage conditions. T-403 type sampler-detectors, except cyclic storage, yielded a 90% reliability at confidence levels greater than or equal to 90% for all storage conditions (reference Appendix C).
5g	Shall be safe (non-hazardous) when used properly in troop training exercises. Potential health hazards will be addressed during all phases of development and testing.	The numbers and type failures that occurred during the test program indicates that the kit is safe to use as intended.
5h	Shall be constructed of materiels that do not provide a toxic disposal problem.	TRAINS is constructed of materiels that do not provide a toxic disposal problem (reference 1, Appendix E).
5i	Pre-engineered devices which will result in positive color tests without the presence of agent simulants will be considered as possible interim training devices.	The TRAINS kit provides sampler-detectors pre-engineered to give simulated positive detection responses for mustard, phosgene oxime, nerve, and blood agent. "All-clear" sampler-detectors are also provided by utilizing actual M256 sampler-detectors for simulated negative responses.

DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005

REPLY TO
ATTENTION OF

DRSTE-AD-A

15 JUL 1982

SUBJECT: TECOM Independent Evaluation Report for DT II of the Training Simulator Set (TRAINS) for the M256 Chemical Agent Detector Kit

Commander
Chemical Systems Laboratory
US Army Armament Research and Development Command
ATTN: DRDAR-CLC-CK
Aberdeen Proving Ground, MD 21010

1. Subject document is forwarded for information and use. The report was developed by TECOM in coordination with the ARRADCOM Red Team.

2. It is concluded that the TRAINS is considered ready for full-scale production.

3. The recommendations are:

a. The TRAINS be accepted in the Army inventory as a stock funded item and entered into the production phase of development.

b. The instruction sheet on the sampler card be sealed in plastic and notches be extended to prevent solvents in the sampler from dissolving the printers' ink.

c. Quality control be tightened to ensure that lewisite tablets are of proper hardness and that samplers are properly marked.

4. The points of contact at this headquarters are MAJ George Franklin, AUTOVON 283-5221/5222 and Mr. Gerald Kadel, AUTOVON 283-3674/3640.

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for HARRY J. PETERS
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REPLY TO
ATTENTION OF

RDCB-DPS-RS

MEMORANDUM THRU Director, Edgewood Chemical Biological Center, (RDCB-D/Mr. Joseph Wienand), 5183 Blackhawk Road, Aberdeen Proving Ground, Maryland 21010-5424

JC
14 OCT 14

FOR Defense Technical Information Center, 8725 John J. Kingman Road, Ft Belvoir, VA 22060

SUBJECT: Internal Request for Change in Distribution

1. This action is in response to an Edgewood Chemical Biological Center (ECBC) Internal Request for a Change in Distribution on documents related to chemical detectors.

2. The listed documents in the attachment have been reviewed by ECBC Subject Matter Experts and deemed suitable for the change in distribution to read "Approved for Public Release; distribution unlimited."

3. The point of contact is Adana Eilo, ECBC Security Specialist, (410) 436-2063 or adana.l.eilo.civ@mail.mil.

Encl

Nancy Carter
NANCY CARTER
Acting Security and Surety Manager

Chemical Detector References

[1] Katzoff, Lionel and Razulis, Marie, Technical Report March 1981 – September 1983, CRDEC-TR-86041, "Engineering Development of the Simulator, Detector Tickets, Chemical Agent: Training M256 (TRAINS), June 1986, UNCLASSIFIED, Distribution B, U.S. Gov't Agencies Only.

[2] Eckhaus, Robert, Technical Report May 1981-June 1984, CRDEC-TR-87054, "Product Improvement Program to Increase the Nerve Agent Sensitivity of the M256 Chemical Agent Detector Kit," June 1987, UNCLASSIFIED, Distribution B, U.S. Gov't Agencies Only.

[3] Ramachandran, C.K., Technical Report February 1988, DPG/TA-88/07, "Reliability of M256 Chemical Agent Detector Kit at Extreme Environmental Temperatures," February 1988, UNCLASSIFIED, Distribution B, U.S. Gov't Agencies Only.

[4] Schwartz, Laura W., Packard, Michael T., Holmes, Celestine T., and McDowell, Charles J., Technical Report April-November 1971, ED-TR-74018, "Evaluation of M15/M18 Enzyme Detector Ticket System with Concentrations of GB, June 1974, UNCLASSIFIED, Distribution C, U.S. Gov't Agencies/Contractors.

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